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U.S. Army Corps of Engineers
New England District

FINAL
FOCUSED FEASIBILITY STUDY REPORT
AREA OF CONTAMINATION 57
DEVENS, MASSACHUSETTS

CONTRACT DACA-31-94-D-0061
DELIVERY ORDER NUMBER 0001

U.S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

NOVEMBER 2000

Harding ESE
A MACTEC COMPANY

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Prepared for:

U.S. Army Corps of Engineers
New England District
Concord, Massachusetts

Prepared by:

Harding ESE, Inc.
A MACTEC Company
Project No. 45001, Task No. 0914404

NOVEMBER 2000

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DEVENS
DRAFT FOCUSED FEASIBILITY STUDY

RESPONSE TO COMMENTS ON THE DRAFT FOCUSED FEASIBILITY STUDY FOR AREA OF CONTAMINATION (AOC) 57

CONTRACT DAAA-31-94-D-0061
DELIVERY ORDER NO. 0001

U.S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DIVISION

September 2000

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RESPONSE TO COMMENTS
ON THE DRAFT FOCUSED FEASIBILITY STUDY
FOR AREA OF CONTAMINATION (AOC) 57

DEVENS, MASSACHUSETTS
SEPTEMBER 2000

HLA's responses to regulatory comments are organized following the format in which the agencies provided comments to the Army. Responses have been provided for each comment.

MADEP Comments on the Draft Focused Feasibility Study,
for Area of Contamination (AOC) 57
July, 2000

General Comments

1. Comment: **Page ES-2, Last Sentence**: Although groundwater at and beneath AOC 57 is not currently being utilized as a source of drinking water, it is a medium yield aquifer, and as such it constitutes a potentially productive aquifer and is considered to be a groundwater resource by the Commonwealth of Massachusetts.

   Response: Reference to the groundwater not being considered a groundwater resource by the Commonwealth of Massachusetts will be deleted.

2. Comment: **Page 2-14, Para 4**: The Remedial Investigation (P 7-20) notes that the trench area of Area 2 has not been completely characterized. Therefore, the full extent of the PCBs are not known and it may be premature for the Feasibility Study (FS) to state that risks attributable to PCBs are generated from a small area of the site.

   Response: Page 7-20 of the RI Report pertains to the 1994 soil removal action at Area 2 and that the trench which was constructed at that time was not successful in determining the limits of contamination based upon a 500 ppm TPH cleanup level. This prompted the RI. The Army believes that the extent of contamination contributing to the risk has been fairly well demarcated in the RI. However, the phrase "in a small area of the site" is a relative description and the Army proposes to replace it with "located within 50 feet south and east of the former excavation area".

3. Comment: **Page 3-10, Section 3.3.32**: The MADEP recommends that extractable petroleum hydrocarbons (EPH) be included as a preliminary remediation goal (PRG) for Area 2 groundwater. Massachusetts Drinking Water Standards and Guidelines for Chemicals in Massachusetts Drinking Waters (Spring 2000) contain guideline concentrations for TPH components.

   Response: A sample collected from 57P-98-02X in May 1998 revealed nondetect EPH concentrations for all EPH carbon groups (less than 200 ug/L C11-C22, and less than 500 ug/L C9-

C18 and C19-C36). As such, there does not appear to be justification for developing a PRG for EPH.

USEPA Comments on the Draft Focused Feasibility Study for AOC 57
June 2000

1. Comment: Cover Letter: (concerning EPA's recommendation that the scope of the proposed remedial action at Area 2 be expanded to address residual contamination in and to the south of the previously-excavated area).

   Response: Removal components for the residual TPH contamination south of the previously-excavated area in Area 2 are included within the FS alternatives (Figure 3-3). Excavation would continue (including in the northward direction into the previously excavated area) until sampling confirms that PRGs have been achieved. For the unrestricted use scenario the cleanup level for TPH is based on a risk-based concentration for the EPH C11-C22 carbon range (930 mg/kg). Only one sampled location, 57S-98-03X at 2 ft bgs contained EPH (990 mg/kg) that exceeded this proposed cleanup level. However, the FS Report does note that there were several sampled locations with elevated TPH concentrations, that were not analyzed for EPH, that are suspected of containing exceedances of the C11-C22 fraction. Calculations in Appendix N of the RI Report suggest that the C11-C-22 fraction represents approximately 22 percent of the total TPH concentration. As such, for FS costing purposes it was assumed those TPH concentrations greater than 4,195 mg/kg may contain C11-C22 with concentrations that exceed its PRG. Confirmation sampling for unrestricted use (Alternative II-4) would include analysis for EPH and be compared with the risk-based concentration of 930 mg/kg. The FFS alternatives are considered protective of the MADEP's potentially productive aquifer. Sampling from 57P-98-02X immediately downgradient of the former soil removal area at Area 2 reveal VPH and EPH concentrations are below the MCP GW-1 standards prior to removing any additional soil.

   With respect to lack of remedial action within the area of previous removal activities, the Army believes that most soil that would exceed COC cleanup levels has been removed. It should be noted that the former removal action description in Section 2 of the FFS refers to the "removal action being suspended until Area 2 could be better characterized" because areas with contamination exceeding 500 mg/kg TPH extended beyond the limits originally estimated. Subsequent to this removal, the Army performed a full RI and a CERCLA risk assessment to redefine cleanup objectives and risk-based cleanup levels. The Army does concur that soil within the former trench area at the south end of the former excavation may contain elevated EPH and PCB concentrations. The FS alternative for protection of residential receptors would address this soil since excavation would continue north until cleanup levels have been achieved (Figure 3-3). The Army also recognizes that three of 24 locations sampled within the previously-excavated area contained elevated TPH concentrations (greater than 4,195 mg/kg) where EPH C11-C22 concentrations may exceed cleanup levels (TP1, TP3, and TP5 in Figure 5-5 of the RI Report). The FFS will be revised

to include pre-design soil sampling within the previously-excavated area for Alternatives II-3 and II-4 to confirm that COC concentrations are below cleanup levels.

With respect to the number of copies of the report submitted to EPA, HLA forwarded the standard 4 copies to EPA per the Devens' document distribution list. If EPA requires additional copies, please contact Dave Margolis with the revised number of required EPA copies.

General Comments

1. Comment: As previously discussed, the proposed response actions for Area 2 should be expanded to address the portion of the site where previous removal actions were incomplete. Test pit samples collected from this area showed significant TPH contamination which was not adequately addressed by backfilling and covering with an "erosion control blanket". The FFS should, at a minimum, recommend that a pre-design sampling program be implemented to evaluate the presence and extent of contamination in the previously-excavated area at Area 2.

   Response: See response to cover letter.

2. Comment: The costing analysis should indicate what criteria were used to estimate the volume of hazardous waste to be excavated for each alternative. Based on the information provided in the FFS, only one sample, with a lead concentration in excess of 5,000 mg/kg, is likely to be characteristically hazardous. Other samples with lead concentrations in the 200 to 300 mg/kg range could be hazardous but are not likely to be hazardous unless prior sampling at the site indicates that they would be. On this basis, it appears that he volume of hazardous waste assumed to be generated in Alternatives II-3 and II-4 is grossly exaggerated. Further, since the majority of the additional excavation associated with Alternative II-4 compared to Alternative II-3 is in the southwest where lead concentrations are low, it is likely that fraction of hazardous waste generated for Alternative II-4 will be much less than that for Alternative II-3. The FFS assumes they are both equal to one-quarter of the volume excavated. Based on a percentage of the samples that are likely to be hazardous in the area to be excavated, the fraction of hazardous waste for Alternative II-3 may reasonably be estimated as 15% and for Alternative II-4 as 7% to 8%. The calculations presented in the FFS should be reviewed in consideration of these comments and a defensible protocol presented for determining the fraction of hazardous waste associated with each alternative.

   Response: Based on discussions with T&D vendors, there is a range of possible costs for disposal of AOC 57 soils depending upon soil characterization. For instance AOC 57 soil may be disposed at a thermal desorption facility out-of-state at $70/ton if the soil contains less than 700 ppm total lead and less than 2 ppm PCBs. This cost may be higher if the soil contains high levels of organic silt and/or is saturated which is likely the case for 25 percent of the soil at AOC 57. Some portions

of Area 2 also contain greater than 2 ppm PCBs and greater than 700 ppm lead. Non RCRA soil with TPH and low level PCBs may also be disposed out-of-state in a Subtitle D landfill at approximately $150 per ton. The concentrations of chromium, arsenic, lead and Aroclor 1260 all preclude their reuse as landfill cover at Massachusetts landfills and require a Special Waste Determination pursuant to 310 CMR 19.00 for disposal at a lined or unlined landfill in the Commonwealth of Massachusetts. Both chromium and lead concentrations exceed their total analysis thresholds (20 times rule) and could fail TCLP. This assumption is appropriate for FFS cost estimated purposes.

Therefore to simplify the estimate for FS costing purposes, the soils were broken into two classifications: soil which can be disposed of relatively inexpensively at approximately $70.00 per ton (MA99 soil) and soil that requires greater expense at approximately $295/ton (RCRA hazardous waste). The costs in the FS were based on the assumption that approximately 25% of the soils would have high disposal costs of approximately $295/ton for Alternatives II-3 and II-4 (which may be a little conservative). The remaining 75% of the soil may be disposed of for approximately $70/ton (which may be a little liberal). Also, given the uncertainty in the requirements for moisture content reduction prior to treatment disposal, estimate is not believed to be "grossly exaggerated".

3. Comment: It appears from Table 2-0 that there are exposure scenarios related to the upland soil at both Area 2 and Area 3 that exceed the allowable risk criterion (HI<1). (For example, a child resident's exposure to surface soil in Area 2 exceeds an HI of 1.6 and in Area 3 exceeds an HI of 1.0. Exposure to both surface and subsurface soil at Area 3 exceeds an HI of 1.3.) It appears that the FFS has not properly addressed the risk associated with these soils. At a minimum, a better explanation as to why these exposure scenarios do not represent excessive risk is required.

   Response: HI values are always reported and judged using 1 significant figure (RAGS, 1989). Only Area 2 upland exceeds HI of 1 (HI=2); the other media/areas cited do not exceed a HI of 1. Area 2 upland does not actually pose a risk because the target-organ specific HI is less than 1. The necessary supporting information is covered in the Risk Assessment in the Final RI Report. The FFS will be revised in Subsection 2.5 and Table 2-10 to clarify this point.

4. Comment: Sediment contamination at Area 2 is not adequately addressed in the FFS, presumably because the non-cancer risk from sediment alone is apparently within the allowable criterion. However, in a child resident exposure scenario, it appears likely that the risk from exposure to mixed media that includes sediment would be excessive. Does the Army plan to address the sediment contamination at and near Area 2 through any other remedial actions planned for Lower Cold Springs Brook? Please explain.

Response: As shown in Table 2-10 of the FFS Report, the HI for multi-media exposure (surface soil, sediment and surface water) is 1 for a recreational child exposure scenario.

5. Comment: Inconsistent units are used throughout the FFS when referring to soils concentrations. Some text refers to ug/g while other text and most tables and figures refer to mg/kg. While both are obviously accurate units, the use of both may be confusing to the reader. Please amend.

   Response: The soil concentration units will be edited so that they are consistent throughout the document.

6. Comment: The USEPA's 11/99 comments on the Human Health Risk Assessment (HHRA) requested that the HHRA assess future residential risk from exposures to soil based on subsurface soil data. Contrary to those comments, the HHRA summarized in this FFS presents surface soil exposure under the future residential scenario. Surface soil is apparently not only included as an exposure medium for the future residential scenarios, but also as a premise for surface soil remediation. Subsurface soils (i.e., 1 - 10') should be used to determine the risks associated with the future residential scenarios.

   Response: As shown in Table 2-10 of the FFS Report and explained in the text (Page 2-13), residential exposures were evaluated for both surface soil and subsoil

7. Comment: Since arsenic is proposed for remediation in groundwater, the Army should consider how the proposed rule for arsenic might effect the Record of Decision, and/or the Long Term Monitoring Plan. The current Maximum Contaminant Level of 50 ug/L is proposed to changed to 5 ug/L in January of 2001.

   Response: Comment noted. Reportedly, the effective date of the revised MCL will be within approximately 3 years after the final rule is issued (promulgation of the final rule is required by January 1, 2001).

8. Comment: The ARARs tables should be organized so that EACH alternative has a complete set of charts (one for Chemical, one for Action and one for Location ARARs). If one or another alternative (such as the no action alternative) does not have any ARARs for Action or Location, that should be stated on a chart even if it is mentioned earlier in the main text.

   Response: The ARAR tables were combined do eliminate duplication between alternatives but will be organized as requested by EPA.

9. Comment: Inspections of institutional controls should include a search of deed records to ensure

that the chain of title contains the proper restrictions so that any purchaser would be aware of them. Because deed restrictions can only be implemented at the time of a deed transfer, the document should be more specific with regards to implementation of these deed restrictions. The long-term effectiveness and permanence discussion should be amended to include the specifics on how the zoning restrictions are to be implemented, e.g. by whom, under what authority, etc.

Response: The level of detail requested is not necessary for the evaluation/comparison of the assembled alternatives. Details with respect to institutional inspections and implementation (e.g., by whom and under what authority) will be covered in the Long Term Monitoring Plan or Land-Use Plan, as they are currently being addressed at other sites at Devens. A sentence will be added to the text of the FFS reflecting this point.

Specific Comments

1. Comment: **Section 1.4.2, Page 1-5 -** The reference to Figure 6-1 in the third paragraph is incorrect; there is no Figure 6-1. Please edit the text to reflect the correct figure reference.

   Response: Figure 6-1 will be changed to Figure 1-4.

2. Comment: **Section 2.1.2, Page 2-2 -** Please clarify that the analyses referred to in the third sentence were for samples collected from the SD-6 system.

   Response: Results are for SD-6 which is referenced in the second sentence. The third sentence will be clarified.

3. Comment: **Section 2.1.3, Page 2-2 -** Please show the location of the 80-foot long trench on an appropriate figure.

   Response: Figure 5-4 of the RI will be added to the FFS for reference to the recovery trench.

4. Comment: **Section 2.1.4, Page 2-3 -** Please show the boundary for the Lower Cold Spring Brook Study on an appropriate figure.

   Response: Figure 5-4 of the RI will be added to the FFS to depict the boundary for the Lower Cold Spring Brook Study.

5. Comment: **Section 2.1.4, Page 2-3 -** The third paragraph refers to a contaminant dike. Please show the location of the dike on an appropriate figure.

Response: Figure 5-4 of the RI will be added to the FFS to show the location of the dike.

6. Comment: **Section 2.3.1.3, Page 2-10** - The last sentence in the first paragraph incorrectly refers to Phase II. The correct reference should be Phase III. Please amend.

   Response: Phase II will be changed to Phase III.

7. Comment: **Section 2.5, Page 2-12** - The last sentence on this page states that a recreational child scenario was evaluated for the possible future use of the site, but the second bullet in this section does not refer to the recreational child scenario for possible future land use. Please review the text for consistency and make the necessary corrections.

   Response: The recreational child was evaluated for current land use. The text on page 2-12 will be corrected.

8. Comment: **Section 2.5, Page 2-13** - The last sentence in the first paragraph states that AOC 57 is not considered a ground water resource by the Commonwealth of Massachusetts. However, since the groundwater at AOC 57 is within a potentially productive aquifer, §40.0932 of the MCP classifies it as GW-1, which appears to contradict the referenced statement. Please review and amend, as necessary, throughout the text.

   Response: Reference to the aquifer at AOC 57 not being considered a groundwater resource by the Commonwealth of Massachusetts will be deleted.

9. Comment: **Section 2.5, Page 2-13** - The second last sentence in the second paragraph states that inorganics may be indirectly associated with petroleum releases at the site. While this may be true, it is also likely that inorganics would have been present in petroleum wastes discarded at the site.

   Response: Comment noted.

10. Comment: **Section 2.5, Page 2-13** - According to the 10/99 iteration of the HHRA, surface soils were used to determine the exposure point concentrations (EPCs) for the future residential scenarios. EPA's November 1999 11/99 HHRA comments and February 2000 comments on the Army's Response to Comments both discuss the problem with assessing future residential soil risks based on surface soil exposure. Since the future residential scenario requires construction of a home, 1 - 10' soils are used to determine the EPC. A new home is presumed to require construction which requires excavation for a foundation. The soil from the excavation (i.e., presumed to be to 10') is presumed to be used as grade for the future residential property. This guidance is presented in Risk Update 3 (8/95). If surface and subsurface soil were combined in some way to assess future

residential exposure to both, then the current subsurface soil assessment will need to be revised. Please present the recalculated risks and hazard quotients/indices based on subsurface soil only. Please also revise calculations, text, and tables as appropriate. These changes will be required in several sections and at least one appendix (e.g., PRG development, proposed alternative evaluation, etc.).

Response: The Army evaluated residential exposures to surface soil and subsurface soil as if each were the only exposure medium at the site. Thus, adding risks between the two media, as done in the Final RA and the FFS, represents an extremely conservative approach. The risk calculations are correct as they stand.

11. Comment: **Section 3.1.1, Page 3-2** - Based on the information presented in Table 2-10, it appears that the following exposures also exceed the non-cancer criterion:

> Area 2 - possible future use scenario: construction worker exposure to wetland surface soil (HI > 1.0)
> Area 2 - unrestricted use scenario: resident child exposure to upland surface soil (HI > 1.6)
> Area 3 - unrestricted use scenario: resident child exposure to upland surface soil (HI > 1.0); combined with upland subsurface soil (HI>1.3).

Please explain in the text why these scenarios were not recommended for an FS. If necessary, make changes throughout the FFS to incorporate these scenarios.

Response: Refer to response to General Comment No. 3.

12. Comment: **Section 3.5.2.1, Page 3-14** - The units for GRO analyses are incompletely presented in the third paragraph. Please insert the appropriate character where missing.

Response: The symbol for "micro" will be added to the units.

13. Comment: **Section 3.5.4.1, Page 3-16** - The sample reference on the first line of this page should be EX57W11X. Please correct.

Response: "W" will be added to the sample reference.

14. Comment: **Section 4.2.1.4, Page 4-4** - In the second paragraph, the prohibition may need to extend to the upland groundwater as well because the zone of influence for an upland well may extend into the contaminated wetland groundwater. Please evaluate.

Response: Prohibition of wells within the upland groundwater at Area 2 may not be necessary depending upon pumping rate and well depth. The Army will add that deeds or other instruments of property transfer for the adjacent upland area at Area 2 should contain advisories recommending that the potential zone of influence of any proposed upland portable wells within Area 2 be assessed with respect to downgradient wetland groundwater contamination. Given that there is a municipal water supply available from Barnum Road, this groundwater exposure scenario is very unlikely.

15. Comment: **Section 4.2.2.2, Page 4-5** - In the first paragraph, the well prohibition for commercial/industrial use should extend to the wetland groundwater as well because the zone of influence for an wetland well may extend into the contaminated upland groundwater. Further, contamination from the upland groundwater will migrate to the wetland and potentially impact wetland wells. Please evaluate.

    Response: Reference to specific groundwater use was retained for continuity with the risk assessment. The text will be clarified to state that wells will be prohibited in upland or wetland areas of Area 3 regardless of whether they are for commercial or residential use. As with Comment No. 14, both groundwater exposure scenarios are very unlikely.

16. Comment: **Section 5.2, Page 5-2** - The reference to Table 5-6 is incorrect; there is no Table 5-6. Please correct. Also, in the third sentence, change "... the three alternatives...." to "... the two alternatives...."

    Response: The second sentence, referencing Table 5-6 will be deleted and the text in the paragraph modified accordingly.

17. Comment: **Section 6.1.2, Page 6-7** - In the third paragraph under Environmental Monitoring, the second to last sentence calls for analysis for arsenic and PCE. However, without the benefit of additional source removal to achieve PRGs for unrestricted use, the analysis suite for groundwater and surface water should be expanded to include all COCs for the site. Note also that naphthalene and 1,1-DCE have been detected at the site in concentrations greater than their respective MCLs.

    Response: Source removal has already been performed at AOC 57. The referenced paragraph pertains to Area 2 and the Army does not believe it is appropriate to combine Areas 2 and 3 to establish an analysis suite for groundwater and surface water. Arsenic and PCE are the only COCs for Area 2 as detailed in Table 3-4 and Subsection 3.3. Naphthalene was detected in groundwater during the RI at a maximum concentration of 20 ug/L in 57M-95-03X (11/95 and 10/96 rounds) based on off-site analysis and at a maximum concentration of 130 ug/L in 57R-96-19X based on field analysis results. These detections were at Area 3. There is no current federal MCL for naphthalene (USEPA, October 1996 Drinking Water Regulations and Health Advisories). The

Commonwealth of Massachusetts lists only a drinking water guideline for naphthalene at 140 ug/L, which is above that detected by field analysis at Area 3.

1,1 DCE was detected only once during the RI in AOC 57 groundwater and only at Area 3 in 57B-96-09X in a field analytical sample. Detected concentration was 95 ug/L. Although this concentration exceeds its respective MCL of 7 ug/L, this one-time exceedance was detected prior to the 1999 removal action and was within a field analytical sample, which is not typically used for RA and PRG development. Subsequent off-site analyses and field screening of groundwater samples collected this year at Area 3 have not revealed the presence of this analyte.

18. Comment: **Section 6.2.3, Page 6-31, third bullet** - As stated previously, it seems appropriate to extend the prohibition for commercial/industrial use to the wetland aquifer as well, because contamination from the upland aquifer will flow into the wetland aquifer and potentially impact wells installed in the wetland

    Response: See response to Specific Comment No. 15.

19. Comment: **Section 7.2.3, Page 7-4** - The text in this section (rather than Section 7.2.5) should also state that because they include additional soil removal, Alternatives II-3 and II-4 are likely to achieve the groundwater ARARs in a shorter time than Alternatives II-1 and II-2. Also, because Alternative II-4 eliminates soils exceeding unrestricted-use PRGs, groundwater ARARs are likely to be achieved more quickly. Finally, for those alternatives that leave contamination in place, the likelihood of further groundwater contamination, including the appearance of COCs not currently detected in the groundwater, could occur.

    Response: In accordance with USEPA Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA (October, 1988), the Long-term Effectiveness and Permanence evaluation criteria is used to evaluate the effectiveness in protecting human health and the environment after response objectives have been met. Whereas the Short-term Effectiveness examines the effectiveness of alternatives in protecting human health and the environment during the implementation period until response objectives have been met. Discussion pertaining to the time required to meet groundwater PRGs is appropriately located in Subsection 7.2.5. Subsection 7.2.5 (line 27-29) already states that groundwater PRGs may be achieved the earliest with Alternative II-4 given that this alternative includes removal of the greatest volume of soil. Given the age of the releases and the extent of former removal actions, it is unlikely that there will be appearances of contaminants that have not already been historically detected in groundwater.

20. Comment: **Figure 1-6 thru 1-9** - Note 1 in all of the figures has an incorrect reference to the figure containing the orientation of the cross sections. Please correct.

Response: The current Figures 1-4 and 1-5 will be appropriately referenced in Note 1 of the subject figures.

21. Comment: **Figure 2-8**: The model appears to be missing a connection between surface soil and receptors. Please correct as necessary.

If the model is intended to include unrestricted land use, then it appears there are exposures missing for area residents. Please review and edit the model as appropriate.

Response: Connection between surface soil and receptors will be added. The model is intended to include only those receptors associated with current or likely land use.

22. Comment: **Figure 3-5** Although the figure title states "surface soil contamination", subsurface results are included in the table. Please revise the table so that only the 0 - 1' samples are included or change the title. Further, please review the data assimilation and ensure that only 0 - 1' sample locations were used to represent the surface soil and 1- 10' sample locations were used represent subsurface soil in the HHRA evaluation.

Response: Figure 3-5 was titled "Wetland Surface Soil Contamination" to reflect that the risk driver (exceedance of an HI of 1) was associated with surface soils although both subsurface and surface soils were evaluated for the residential exposure scenario (refer to Table 2-10). However, because the Army intends to excavate lower than 1 feet bgs for remediation, "surface" will be deleted from the title to eliminate confusion. Note 1 on Figure 3-5 states that subsurface soil sample results and upland soil results are depicted for the purpose of delineating the PRG exceedances. As discussed in Subsection 3.5.4, the soil contamination noted during the Removal Action was primarily confined to an organic silty sand varying in thickness from 2 inches to 1-foot. This layer varied in depth from 3 to 5 feet in the northern end of the former soil removal area to 1 foot at the far southern extent of the excavation. As also discussed in Subsection 3.5.4, the Army has assumed for remedial alternative costing purposes that excavation depth required to meet the PRG would be an average of approximately 3 feet (i.e., the Army may excavate both surface soil and subsurface soil should Alternative III-3 be selected).

23. Comment: **Table 2-10** - Surface soil and subsurface soil are presented separately for the residential child and adult exposure scenarios. If subsurface hazard indices are based on exposure parameters for the residential scenarios exclusive of the surface soil exposure, then the subsurface hazard indices may be used to assess the need for remedial action. However, the exposure parameters would need to represent exposure to the subsurface only (e.g., incidental ingestion would all need to be from the subsurface soil). Please provide a summary table of the exposure

parameters and, if necessary, change the parameters to address only subsurface soil for the future residential exposure scenarios. Please also eliminate the future residential surface soil evaluation. Some discussion of the variation between the HHRA surface soil and corrected subsurface soil risk evaluation should also be discussed (i.e., executive summary and Section 2). Of course, the exposure medium for the development of the PRGs based on residential exposures should also be based on only subsurface soil.

Response: See response to Specific Comment No. 10.

24. Comment: **Table 3-1** - Since hazard indices are totals of hazard quotients, the 4th column title should simply read "Hazard Index".

Response: "Total" will be deleted from the column title.

25. Comment: **Tables 3-3 & 3-4, footnote (b)** - In addition to the text in the current footnote, please note which background data set statistic the tabulated values represents (e.g., arithmetic average, upper prediction limit, etc.).

Response: This detail is not easily presented as a footnote to the tables. For instance, background concentrations of inorganics in groundwater are generally based on a conservative 68th percentile. However, the method detection limit is also used for some analytes depending upon the concentrations detected. For a description of the methodology used in computing background concentrations, the reader is encouraged to see Appendix L of the RI Report.

**Ecological Comments on the Draft Focused Feasibility Study
For Area of Contamination (AOC) 57**

1. Comment: The FFS fails to address the ecological risk-related comments offered by EPA on the AOC 57 RI. Although the Army's response to comments agreed to expand the uncertainties discussion in the RI, this discussion should have been carried through the FFS.

   Response: To address this and subsequent USEPA comments on ecological risk, the Army has provided below (in italics) an uncertainty added to the AOC 57 baseline ERA. This uncertainty, taken directly from Section 9.2.7 of the Final AOC 57 RI (HLA, 2000), discusses the detailed evaluation of risk for those chemicals screened out of the baseline ERA using background, upgradient, and/or published values (Rojko, 1990). Supporting tables referenced in this uncertainty are presented in the Final AOC 57 RI (HLA, 2000).

   ξ *There is uncertainty associated with potential risks to ecological receptors from exposure to chemicals that had been eliminated from the ERA based on a comparison with background concentrations for surface soil, and upgradient concentrations and/or published values for Massachusetts lakes and ponds for surface water and sediment. Consequently, these potential risks have been quantified as part of the uncertainty analysis. Given that these chemicals were eliminated from the ERA because maximum concentrations were less than background, upgradient, or published concentrations for Massachusetts lakes and ponds, it is anticipated that potential risks from these chemicals are negligible, or are representative of general conditions of the area.*

   Tables 9-47 through 9-53 depict the CPC selection process for surface soil, surface water, and sediment at Areas 2 and 3 of AOC 57. For those chemicals eliminated as CPCs (excluding the essential nutrients), summary statistics and RME and average exposure concentrations are presented in Appendix O-3, Tables O-3.1 through O-3.6. Risks to ecological receptors were evaluated for these chemicals by the same processes outlined for those chemicals retained as CPCs in the baseline ERA.

   Food chain risks for terrestrial and semi-aquatic wildlife were quantified for chemicals eliminated as CPCs using the same representative wildlife receptors and exposure assumptions as for chemicals retained as CPCs. The results of this evaluation are presented in Tables O-4.1 through O-4.10 in Appendix O-4 and summarized in Table O-3.7 in Appendix O-3. These results indicate that wildlife receptors are not at risk from exposure to chemicals eliminated as CPCs because all HIs are less than 1. When combined with the HIs

calculated for CPCs that were retained in the ERA, the additional risk to wildlife receptors are negligible (Table O-3.7). For both Area 2 upland and Area 3 surface soil, the combined HIs for the American robin slightly exceed or are equal to 1; population-level effects are not likely to occur for small omnivorous bird populations at these low risk levels. This evidence indicates that terrestrial and semi-aquatic wildlife receptors are not at risk from exposure to chemicals eliminated as CPCs in surface soil, surface water, and sediment.

Potential risks to terrestrial plants and soil invertebrates were evaluated for chemicals eliminated as CPCs in surface soil by the same method as for chemicals retained as CPCs. The results of this evaluation, which are shown in Tables O-3.8 through O-3.10 for Area 2 upland, Area 2 floodplain, and Area 3 (respectively) indicate that soil invertebrates are not at risk from exposure to chemicals eliminated as surface soil CPCs. However RME and average exposure concentrations of aluminum, chromium, and vanadium all exceed phytotoxicity benchmarks by approximately 2, 1, and 1 orders of magnitude (respectively). The phytotoxicity benchmarks for aluminum, chromium, and vanadium were derived by the Oak Ridge National Laboratory (Will and Suter, 1994) by selecting the 10th percentile value of rank ordered LOEC values obtained from studies using sensitive crop species (e.g., soybean, lettuce, tomato, oats, and clover). Unfortunately, few studies for these chemicals were available (n=1, 7, and 2 for aluminum, chromium, and vanadium, respectively). Consequently, the authors assigned a low level of confidence to these benchmarks, suggesting that there is a high degree of uncertainty associated with these phytotoxicity benchmarks. Furthermore, background values for aluminum, chromium, and vanadium in Devens soil exceed the phytotoxicity benchmarks by higher factors (360, 33, and 16, respectively), suggesting that the phytotoxicity benchmarks are overly conservative for this region. These benchmarks have not changed since this document was updated in 1997 (Efroymson et al., 1997). This evidence indicates that terrestrial plants and soil invertebrates are not at risk from exposure to chemicals eliminated as CPCs in surface soil.

Potential risks to aquatic receptors were evaluated for chemicals eliminated as CPCs in surface water and sediment by the same method as for chemicals retained as CPCs. Manganese at Area 3 was the only analyte eliminated as a CPC in surface water. A comparison of the Area 3 manganese RME and average exposure concentrations with the surface water benchmark, presented in Table O-3.11 in Appendix O-3, indicates that aquatic organisms are not at risk. Tables O-3.12 and O-3.13 in Appendix O-3 show a comparison of sediment concentrations of chemicals eliminated as CPCs with sediment benchmarks. These comparisons indicate that RME and average exposure concentrations of cadmium in Area 2 sediment, and arsenic, barium, and lead (RME only) in Area 3 sediment exceed the most conservative sediment benchmarks by factors of approximately 4, 6, 3, and 2 (respectively). Upgradient concentrations of arsenic, barium, and lead exceed these benchmarks by factors of

approximately 18, 5, and 7 (respectively). Under laboratory toxicity test conditions, aquatic organisms experienced no adverse effects when exposed to sediment from Area 2 containing much higher concentrations of these metals, suggesting that the sediment benchmarks are overly conservative for evaluating risk at AOC 57. This evidence indicates that aquatic organisms are not at risk from exposure to chemicals eliminated as CPCs in surface water and sediment.

2. Comment: Some uncertainty remains with respect to selection of CPCs in the ERA, raising the concern that the FFS may not be protective of ecological receptors at the site. The evaluation was undertaken to determine the impact of the CPC selection method for sediments on the overall conclusions of the ERA. The selection of CPCs in the ERA was performed using a combination of site-specific background and literature background data sets for inorganic chemicals. This approach is not risk-based, and is likely to result in chemicals being eliminated from further evaluation even when they may contribute to risk. (This comments applies only to inorganic chemicals. Organic chemicals appear to have been retained as CPCs if they were detected, which is appropriate.)

   Examples of chemicals that may have been inappropriately excluded as CPCs are arsenic, copper, lead, manganese, and zinc. The background concentrations of arsenic (110 mg/kg) exceed the Ontario Ministry of the Environment (OMOE) Severe Effect Level (SEL), and the background concentrations of copper, lead, manganese, and zinc exceed their respective Lowest Effect Levels (LELs) (Jaagumagi, 1995). All of these chemicals were eliminated as CPCs for Area 3 sediments. While the background concentrations are relevant from a risk-management perspective, they should not be used to identify CPCs.

   Response: The uncertainty from the baseline ERA in the AOC 57 RI evaluated risks to aquatic organisms from exposure to surface water and sediment chemicals eliminated as CPCs. This uncertainty shows that manganese in surface water does not pose a risk to receptors. Although concentrations of arsenic, barium, cadmium, and lead in Area 2 and/or Area 3 sediment exceed benchmarks (by factors of 6 or less), the toxicity test results indicate that much higher concentrations of these metals were not toxic to *H. azteca* or *C. tentans*. Therefore, the baseline ERA reached a conclusion of no risk for these and other metals eliminated as CPCs based on upgradient concentrations or the published values for Massachusetts lakes and ponds.

3. Comment: The document entitled, "Heavy Metals in Sediments of Massachusetts Lakes and Ponds" (Rojko, 1990), was used in lieu of background data for inorganic chemicals in Cold Spring Brook sediments. This reference is suitable only for evaluating chemicals for which neither risk-based screening values nor reasonable upgradient sample data are available.

Response: Refer to response to comment #2.

4. Comment: The FFS appears to be based entirely on conclusions involving human health risks. The preliminary remediation goals (PRGs) for the site are based on human health exposures for potential future re-use of the site. The FFS states that no chemicals were brought forward to the PRG stage from the ecological risk assessment (ERA), because overall ecological risk was found to be low. This conclusion warrants reconsideration in light of the comments contained herein.

   Response: Based on the information presented in the RI ERA uncertainties and response to comment #2 above, the conclusion that there are no chemicals requiring further attention for ecological concerns is still valid.

5. Comment: Contaminant concentrations detected in Areas 2 and 3 sediments were compared to the OMOE LEL and SEL values in order to identify chemicals that had maximum concentrations above the LEL or SEL values, but were eliminated from further consideration on the basis of background. The results indicate that: (1) the maximum concentration of cadmium exceeded its LEL value in Area 2 sediment; (2) the maximum concentrations of arsenic exceeded its SEL value in Area 3 sediment; and, (3) lead exceeded the LEL value in Area 3 sediment. Based on the comments contained herein and the fact that all of these chemicals exceeded their applicable benchmarks, their omission from the risk assessment may warrant reconsideration.

   Response: As discussed in the uncertainty and in response to comment #2 above, a conclusion of no risk from metals eliminated in the CPC selection process relied more on the site-specific toxicity test results, in which no significant adverse effects to test organisms were observed.

6. Comment: Future ERAs should use only risk-based values in the CPC selection process. Risk attributable to background should be addressed in the Risk Characterization section of the ERA, not in the screening of CPCs.

   Response: Agreed.

7. Comment: The risk assessment does not address the effect that the CPC selection would have on food chain modeling. The omission of chemicals from food chain modeling based on background concentrations could underestimate risk. A more in-depth study, including recalculation of food chain risks, would be required to fully resolve this question. Sediment data were evaluated because these were the only data for which actual biological effects data were available.

In order to fully characterize risk from food chain exposures, a re-screening of the sediment data is needed, followed by food chain modeling using 95% UCL and mean exposures for any chemicals added to the ERA based on the new screening. For Area 2, cadmium should be added to the food chain models. For Area 3, arsenic and lead should be added. EPA recommends that the Army prepare a technical memorandum that includes the additional calculations and text needed to adequately address the aforementioned concerns. If the recalculations substantially change the findings of the ERA, the options considered under the FFS may need to be altered as well.

Response: The food chain risks for both terrestrial and semi-aquatic wildlife receptors exposed to surface soil and surface water/sediment (respectively) were re-evaluated considering metals eliminated as CPCs. This is presented in the uncertainty included in the baseline ERA for the AOC 57 RI, along with supporting documentation (Appendices O-3 and O-4). In summary, no additional or cumulative risks were identified for terrestrial or semi-aquatic receptors exposed to metals eliminated as CPCs in surface soil or surface water/sediment.

8. Comment: In future ERAs, risk attributable to background conditions should be presented in the risk characterization section and screening should use only risk-based ecotoxicological benchmarks. The selection of CPCs based on a comparison with background concentrations may leave out important risk contributors

Response: Agreed.

PACE Comments on the Draft Focused Feasibility Study For Area of Contamination (AOC) 57 Dated August 8, 2000

COMMENTS

1. Comment: A small number of alternatives are discussed in this "focused" feasibility study. For Area 2, four alternatives were evaluated, including the "No Action" alternative. Only two of these alternatives involved the excavation of contaminated soil. For Area 3, only one of the three alternatives included excavation of contaminated soil. Each alternative relies on deed restrictions to control future use of ground water as a source of potable water. None of the alternatives included direct, active measures to address ground water contamination. **Therefore, although the purpose of the FFS report is not to select a remedy, the FFS effectively rules out active remediation of ground water via omission.**

   AOC 57 lies just outside the Zone II of the Ayer Grove Pond wells, and Cold Spring Brook flows to Grove Pond, which contributes water to the Ayer wells. Further, AOC 57 is within a medium-yield Potentially Productive Aquifer, which is protected under Massachusetts regulations. The proper consideration of the MCP as an ARAR by the Army would lead to the requirement that ground water be restored to drinking water standards. GeoInsight therefore believes that the FFS is incomplete without the incorporation of alternatives involving active ground water remediation. To protect the aquifer, GeoInsight recommends the inclusion of alternatives for restoration of ground water to drinking water quality.

   Response: While it is true that none of the alternatives in the FFS include direct, active remediation of groundwater contaminants, active remediation was not simply omitted from the FFS but was considered by the Army and screened out in Section 4 of the FFS for several reasons. First, the Army believes that considerable remedial actions have already been implemented with respect to groundwater remediation in the form of source control (removal actions). Given that these removals were relatively recent (1994 at Area 2 and 1999 at Area 3) in relation to the groundwater sampling events, the full benefit from these actions on groundwater contaminant concentrations has not been given sufficient time to be recognized. It should be noted however that even with an insufficient time to see groundwater improvement following these source removals, there are only a few marginal and often sporadic exceedances of the preliminary remediation goals (PRGs).

   Secondly, over 90 percent of the carcinogenic risks and all of the noncarcinogenic risks exceeding a HI of 1 from groundwater are due to the presence of arsenic. As discussed in the FFS Report, the arsenic is naturally occurring. Reducing conditions caused by the biodegradation of the organic contaminants have released naturally occurring arsenic in soil to groundwater and caused elevated levels of arsenic in

groundwater. The soil removal action performed in 1994 at Area 2 has significantly reduced petroleum contamination in soil, thereby minimizing the probable leaching of naturally occurring arsenic.

Third, since groundwater at AOC 57 is not used as a source of drinking or industrial water, the risk evaluation of potable groundwater use represents a hypothetical worst-case evaluation of potential exposures and risks. There are no current exposures to groundwater, Devens already has a municipal water supply, and the AOC is not within a delineated Zone II aquifer area. Fourth, there would be difficulty of effectively but practically treating mixed residual inorganic and organic contaminants (i.e., separate technologies would be required for effective treatment) and given the above factors, implementation of an active remedial technology was screened-out. These considerations do not diminish the Army's recognition of the importance of meeting the remedial objective of achieving drinking water standards at AOC 57. For all alternatives, deed restrictions and environmental monitoring would be continued until MMCLs and MCLs are achieved in groundwater at the site.

With respect to the second paragraph of Comment No. 1, CERCLA requires that the selected alternatives meet the second threshold criterion of compliance with ARARs, or a waiver be obtained if the criterion can not be met. This criterion, according to CERCLA, must be met for a remedial alternative to be chosen as a final site remedy. At AOC 57, it is the Army's belief that the chemical-specific ARARs (drinking water standards) will be achieved. Deed restrictions and environmental monitoring would be continued only until MMCLs and MCLs are achieved in groundwater at the site. Consideration of the MCP as an ARAR would not effect these remedial objectives.

2. <u>Comment:</u> The FFS does not include the Massachusetts Contingency Plan (MCP) as an Applicable or Relevant and Appropriate Requirement (ARAR). The rationale for this decision is summarized in text that is essentially identical to that found in the AOC 50 Remedial Investigation. GeoInsight's comments on the AOC 50 RI addressed this issue, and the Army responded in their Response to Comments. After consideration of the Army's response, GeoInsight still has concerns regarding this issue. GeoInsight does not agree with the Army's argument that the MCP is "mostly administrative" in nature. Relevant examples of substantive requirements include the following:

   ξ Cleanup goals for both oil and hazardous materials are defined in the MCP. The goals themselves, as well as the means for determining to what situations the goals apply, can result in substantially different outcomes for sites regulated under MCP vs. CERCLA. AOC 57 serves as a good example. <u>If AOC 57 was regulated under the MCP, the deed restrictions proposed by the Army would not be an acceptable alternative, and cleanup would not be complete until drinking water standards were attained.</u>

- The calculation of risk under the MCP must incorporate all identified exposure pathways. Under CERCLA, Preliminary Remediation Goals (PRGs) can be used to "screen out" media such as surface soil, ground water, etc. As a result, the risks calculated using MCP methodology can be higher than those calculated under CERCLA.

As discussed above, the scope of the feasibility study at AOC 57 would have been considerably different had the MCP been considered, because active remediation of ground water would be required to protect the Potentially Productive Aquifer. GeoInsight believes that the MCP issue at Devens can be critical to the outcome of site cleanups, and reiterates the importance of this issue. In short, it does not seem reasonable that a cleanup under Superfund should be allowed to meet less stringent standards than cleanups performed at similar sites elsewhere in Massachusetts.

Response: As has been previously discussed and noted in the RI and FFS Reports, the MCP is not considered an ARAR under CERCLA. With respect to the first bullet, cleanup at AOC 57 under CERCLA is not considered complete until drinking water standards are attained unless a waiver is obtained. The Army is not seeking a waiver. Therefore, the MCP is no more stringent from this respect. The second bullet that infers that risks using the MCP methodology can be higher than those calculated under CERCLA is not entirely correct. It is true that the MCP must incorporate all identified exposure pathways while screening values can be used in CERCLA to "screen-out" less contaminated media. However, it should be noted that the CERCLA screening values are conservative values (1/10th the risk limit) and therefore the affected media would contribute negligibly to the overall risk. It should also be noted that there are a number of instances where the MCP approach is less conservative than CERCLA (e.g., the MCP provides opportunity to screen out CPCs if lower than background concentrations, and utilizes exposure values which are approximately 1/2 the USEPA Region I risk assessment guidelines for computing the ingestion risk.) As such, the last sentence in the 2nd bullet would be more correctly stated as "the risks calculated using MCP methodology can be higher or lower than those calculated under CERCLA". These differences are precisely why the risk assessment procedures in the MCP are not considered an ARAR by USEPA or MADEP for sites remediated under the CERCLA process.

3. Comment: Although it is recognized that the purpose of this report is not to select a remedy, GeoInsight wishes to express, on behalf of PACE, its preference for alternatives that involve active remediation of both Areas 2 and 3, as opposed to the sole use of deed restrictions and ground water monitoring. During prior excavation at Area 2, the Army elected to discontinue further soil removal pending the completion of the RI. Now that the RI has delineated the extent of contaminated soils and shown that risks are present, the removal action should be completed. The cost and level of effort required for additional excavation are not great compared to the benefit of restoring this environmentally sensitive

area. Further, as discussed above, **ground water should be restored to drinking water quality to protect the medium-yield aquifer at the site**.

Response: Comment noted. The preferred alternative will be presented in the Proposed Plan for review and comment. Refer to the responses to Comment No. 2 with respect to the alternatives meeting drinking water standards.

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FINAL
FOCUSED FEASIBILITY STUDY REPORT
AREA OF CONTAMINATION (AOC) 57

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EXECUTIVE SUMMARY

Harding ESE, *A MACTEC Company* (Harding ESE), formerly Harding Lawson Associates (HLA) has prepared this Focused Feasibility Study (FFS) Report to support Task Order 001 of Contract DACA-31-94-D-0061 under the oversight of the U.S. Army Corps of Engineers (USACE) – New England District. This report addresses the contaminated soil and groundwater at Area of Contamination (AOC) 57, which is located at the former Fort Devens, Massachusetts. This FFS Report is prepared as part of the Feasibility Study (FS) process in general accordance with the 1988 U.S. Environmental Protection Agency (USEPA) guidance document entitled *Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA*. The purpose of the FFS Report is to identify and screen potentially feasible alternatives to control human health risks at AOC 57. Following this screening, the FFS Report presents a detailed analysis of the remedial alternatives.

Fort Devens was identified for cessation of operations and closure under Public Law 101-510, the Defense Base Realignment and Closure (BRAC) Act of 1990, and was officially closed in September 1996. Portions of the property formerly occupied by Fort Devens were retained by the Army for reserve forces training and renamed the Devens Reserve Forces Training Area (RFTA). Areas not retained as part of the Devens RFTA were, or are in the process of being, transferred to new owners for reuse and redevelopment. AOC 57 is located in an area planned for transfer to the MassDevelopment for industrial/trade-related development and recreation/open space.

Site Conditions

AOC 57 is located between Barnum Road and Cold Spring Brook on the northeast side of what was formerly the Main Post (Figure ES-1). It is in an area of the former Fort Devens that has been used primarily for the storage and maintenance of military vehicles. The portion of AOC 57 that is the focus of this report consists of two subsites (Area 2 and Area 3) located south to southeast of former vehicle storage yards. Areas 2 and 3 at AOC 57 historically received storm water runoff and wastes from vehicle repair at these yards. The vehicle storage yards were abandoned in 1998, and the pavement and fencing were removed. The yards are now grass-covered areas. Areas 2 and 3 include an upland area (elevations between 228 and 240 ft mean sea level [msl]) that slopes downward to a delineated wetland area (elevations lower than 228 ft msl). At Area 2 the wetland boundary is located approximately 250 feet from Cold Spring Brook, and at Area 3 the wetland boundary is located approximately 500 feet from Cold Spring Brook. The upland area is forested with trees and scrub brush. The wetland area is densely vegetated with brush and contains small areas of standing water.

Area 2 formerly consisted of an eroded drainage ditch created by periodic rain runoff (Figure ES-2). The area has since been regraded, and a permanent drainage swale has been installed. Runoff drains into the swale and discharges east to Cold Spring Brook. The

formerly eroded drainage ditch at Area 2 was investigated following detection of naphthalene and total petroleum hydrocarbons (TPHC) in surface soils during a 1993 site investigation. Subsequent sampling confirmed the presence of TPHC and polycyclic aromatic hydrocarbons (PAHs) in surface soil. Based on the results of these investigations, the Army performed a soil removal action at Area 2 in 1994. Approximately 1,300 cubic yards (cy) of soil were excavated. During the removal action, it was discovered that the soil/groundwater contamination was more widespread than expected. The soil removal was stopped, and AOC 57 Area 2 was administratively transferred to the Remedial Investigation (RI)/FS process. At the completion of the removal action, the area was regraded and a permanent drainage swale was installed. Results of sampling conducted during and at the completion of the removal action in 1994 indicated the presence of TPHC, polychlorinated biphenyls (PCBs), lead, and volatile organic compounds (VOCs) in soil and/or groundwater at the site. Reducing conditions caused by the contamination have also released naturally occurring arsenic in soil to groundwater and caused elevated levels of arsenic in groundwater. The soil and groundwater contamination is located around the southern perimeter of the soil removal excavation from the ground surface to the water table at approximately 4 to 5 feet below ground surface (bgs).

Area 3 is located approximately 600 feet to the northeast of Area 2 (Figure ES-2). The site is characterized by a historic garage and vehicle waste disposal area. A RI was prompted in 1995 and 1996 to address soil staining observed in historical photos. Data collected during the RI showed that a historic garage waste disposal site approximately 40 feet square by five feet in depth was acting as a source of soil and groundwater contamination. Removal activities were conducted in 1999, accordance with an Action Memorandum for AOC 57. In total, 1860 cy of soil was removed during the Area 3 soil removal. Residual extractable petroleum hydrocarbons (EPH), PCB, and pesticides contamination remained in soils near the southern end of the excavation.

Human Health Risk

The RI Report evaluated potential human-health risks associated with exposure to site contaminants in soil, groundwater, surface water, and sediment based upon sampling data collected during the RI (HLA, 2000). Possible health risks were evaluated for the current land uses, possible future land uses, and unrestricted land uses at AOC 57. Although the site is presently not used for any specific purposes, and is not located near any properties with active land uses, exposures and risks for current site use were evaluated for a site maintenance worker (possible exposure to surface soil), and a trespasser ages 6 through 16 (possible exposure to surface soil, surface water, and sediment). The health risks associated with possible future site use were evaluated assuming that the upland portion of the site will be redeveloped for commercial/industrial use, and included evaluation of a commercial/industrial worker (possible exposure to surface soil and groundwater) and an excavation worker (possible exposure to surface soil and subsurface soil). Possible health risks for the possible future use of the wetland areas were evaluated assuming that the

areas could be used for passive recreational/open space use. Therefore, the possible health risks associated with future use of the wetland area of the site were evaluated for a construction worker (possible exposure to surface soil and subsurface soil). In addition, to aid in risk management decision-making and to determine if additional response actions may be required at AOC 57, future unrestricted land use was evaluated by assuming that child and adult residents would live at the site (possible exposures to surface soil, subsurface soil, and groundwater). Since groundwater at and beneath AOC 57 is not used as a source of drinking or industrial water, and the area is serviced by a public water supply, evaluation of potable groundwater use represents a hypothetical worst-case evaluation of potential exposures and risks.

Human-health risks exceeded the USEPA points of departure (i.e., risk management guidelines corresponding to cancer risks exceeding the range of $1x10^{-4}$ to $1x10^{-6}$ and noncancer hazard index values exceeding 1) for some soil and groundwater possible future use and unrestricted use exposure scenarios.

Remedial Action Objectives

Remedial action objectives (RAOs) are developed in the FFS for those exposure scenarios where human health risks exceed the USEPA points of departure. Based on the results of the risk assessment, the following RAOs developed for AOC 57:

Area 2 - Possible Future Use Scenario (Construction Worker)

- Protect potential construction workers that might work within future recreational (wetland) areas at Area 2 from ingesting soils containing Aroclor-1260 and lead in excess of preliminary remediation goal (PRG) concentrations considered protective of human health (3.5 and 600 milligrams per kilograms (mg/kg), respectively).

Area 2 - Unrestricted Land Use Scenario (Residential)

- Prevent potential residential receptors from coming in dermal contact and ingesting Area 2 wetland soils containing Aroclor-1260, arsenic, chromium, lead, and the EPH C11-C22 aromatic carbon range in excess of PRG concentrations considered protective of human health (0.5, 21, 550, 400, and 930 mg/kg, respectively).

- Prevent residential potable use of Area 2 wetland groundwater containing arsenic and tetrachloroethylene (PCE) in concentrations that exceed federal maximum contaminant level (MCL)/Massachusetts maximum contaminant level (MMCL) drinking water standards (50 and 5 micrograms per liter (μg/L), respectively).

Area 3 - Possible Future Use Scenario (Commercial/Industrial Worker)

- Protect potential future commercial/industrial receptors from ingesting upland Area 3

groundwater that contains arsenic, cadmium and 1,4-dichlorobenzene (!,4-DCB) in concentrations that exceed MCL and MMCL drinking water standards (50, 5, and 5 μg/L, respectively).

Area 3 - Unrestricted Land Use Scenario (Residential)

- Prevent residential potable use of Area 3 upland groundwater containing arsenic, cadmium and 1,4-DCB in concentrations that exceed MCL and MMCL drinking water standards (50, 5, and 5 μg/L, respectively).
- Prevent residential potable use of Area 3 wetland groundwater containing arsenic and PCE in concentrations that exceed MCL and MMCL drinking water standards.
- Prevent potential residential receptors from coming in dermal contact and ingesting surface soils containing the EPH C11-C22 aromatic carbon range in excess of the PRG concentration considered protective of human health.

Remedial Alternatives

The FFS Report identifies and screens response actions and potential remedial technologies that are capable of attaining the RAOs. Remedial alternatives are assembled using these identified remedial technologies. The alternatives are then screened based on the criteria of effectiveness, implementability, and cost. All the assembled alternatives are retained for detailed analysis in the FFS Report. The detailed analysis evaluates these alternatives with respect to the seven evaluation criteria defined by the National Contingency Plan (NCP).

Alternatives that undergo detailed analysis and comparative analysis for Area 2 include:

Alternative II-1: No Action

Alternative II-2: Limited Action

- Institutional Controls:
  - Land-use restrictions that control excavation activities at the Area 2 wetland
  - Land-use restrictions that restrict residential use of wetland property and potable use of the aquifer
- Environmental Monitoring:
  - Long-term groundwater monitoring
  - Long-term surface water monitoring
- Institutional Control Inspections
- Five-year Site Reviews

Alternative II-2, is designed to reduce potential human-health risks associated with contaminated soil and groundwater at the Area 2 wetland. This alternative would consist of implementing institutional controls indefinitely to protect possible future-use (construction worker) receptors and unrestricted-use (residential) receptors. Deed restrictions would be easily implemented considering that AOC 57 wetland area is slated for recreational/open space. Environmental monitoring in the form of groundwater and surface water sampling would be performed at the site to assess for groundwater contaminant of concern (COC) migration and to assess for eventual reduction of COCs to PRGs by natural attenuation processes. Five-year site reviews would be performed to ensure that the remedial alternative remains protective of human health and the environment.

The estimated 30-year net present worth (NPW) cost to implement Alternative II-2 is $244,000. A cost sensitivity analysis revealed that a reduction in sampling duration to only 3 years (assuming groundwater cleanup by natural processes occurs within 3 years) decreases the overall 30-year NPW cost to $143,000.

Alternative II-3: Excavation (For Possible Future Use) And Institutional Controls

- Wetlands Protection
- Soil Excavation and Treatment/Disposal at an Off-Site treatment/storage/disposal (TSD) Facility
- Institutional Controls:
  - Land-use restrictions that restrict residential use of wetland property and potable use of the aquifer
- Environmental Monitoring:
  - Long-term groundwater monitoring
  - Long-term surface water monitoring
- Institutional Control Inspections
- Five-year Site Reviews

Alternative II-3 is designed to reduce potential human-health risks associated with contaminated soil and groundwater at the Area 2 wetland. This alternative would consist of excavating approximately 640 cy of contaminated soil to protect possible future-use (construction worker) receptors and implementing institutional controls indefinitely to protect unrestricted-use (residential) receptors from exposure to soil. Deed restrictions would also be imposed to prohibit potable use of groundwater until PRGs are achieved. Because excavation would be performed within the wetlands, wetland protection, restoration and monitoring would also be required. Environmental monitoring and 5-year site reviews would be would be performed at the site as discussed for Alternative II-2.

The estimated 30-year NPW cost to implement Alternative II-3 is $667,000. A cost sensitivity analysis revealed that a reduction in sampling duration to only 3 years (assuming groundwater cleanup by natural processes occurs within 3 years) and 25 percent reduction in the estimated quantity of soil requiring excavation decreases the 30-

year NPW cost to $515,000. A 25 percent increase in the estimated quantity of soil requiring excavation increases the 30-year NPW cost to $719,000.

Comparison of the NPW costs over 30 years reveals that the benefit of achieving possible future-use PRGs in soil (difference between Alternatives II-2 and II-3), costs approximately $423,000.

Alternative II-4: Excavation (For Unrestricted-Use) And Institutional Controls

- Wetlands Protection
- Soil Excavation and Treatment/Disposal at an Off-Site TSD Facility
- Institutional Controls:
  - Land-use restrictions that restrict potable use of the aquifer
- Environmental Monitoring:
  - Long-term groundwater monitoring
  - Long-term surface water monitoring
- Institutional Control Inspections
- Five-year Site Reviews

Alternative II-4, is designed to reduce potential human-health risks associated with contaminated soil and groundwater at the Area 2 wetland. This alternative would consist of excavating approximately 1,800 cy of contaminated soils to protect unrestricted-use (residential) receptors and implementing institutional controls to protect receptors from potable use of contaminated groundwater. Wetland protection, environmental monitoring and 5-year site reviews would be would be performed at the site as discussed for Alternative II-3.

Estimated 30-year NPW cost to implement Alternative II-4 is $1,321,000. A cost sensitivity analysis revealed that a reduction in sampling duration, institutional controls and site reviews to only 3 years (assuming groundwater cleanup by natural processes occurs within 3 years) and 25 percent reduction in the estimated quantity of soil requiring excavation decreases the NPW cost to $1,028,000. A 25 percent increase in the estimated quantity of soil requiring excavation increases the 30-year NPW cost to $1,466,000.

Alternatives that undergo detailed analysis and comparative analysis for Area 3 include:

Alternative III-1: No Action

Alternative III-2: Limited Action

- Institutional Controls:
  - Land-use restrictions prohibiting residential use of wetland property (soil), and commercial/industrial and residential potable use of the aquifer.

- Environmental Monitoring
  - Long-term groundwater monitoring
  - Long-term surface water monitoring
- Institutional Control Inspections
- Five-year Site Reviews

Alternative III-2, Limited Action, is designed to reduce potential human-health risks associated with contaminated soil (wetland) and groundwater (upland and wetland) at the Area 3. This alternative would consist of implementing institutional controls to protect possible future-use (commercial/industrial) and unrestricted-use (residential) receptors. Environmental monitoring, in the form of groundwater and surface water monitoring would be performed at the site to assess for groundwater COC migration. Five-year site reviews would be performed to ensure that the remedial alternative remains protective of human health and the environment.

The estimated 30-year NPW cost to implement Alternative III-2 is $298,000. A cost sensitivity analysis revealed that a reduction in sampling duration to only 7 years (assuming groundwater cleanup by natural processes occurs within 7 years) decreases the overall 30-year NPW cost to $200,000.

<u>Alternative III-3: Excavation (For Unrestricted-Use) And Institutional Controls</u>

- Wetlands Protection
- Soil Excavation and Treatment/Disposal at an Off-Site TSD Facility
- Institutional Controls:
- – Land-use restrictions prohibiting commercial/industrial and residential potable use of the aquifer
- Environmental Monitoring:
  - Long-term groundwater monitoring
  - Long-term surface water monitoring
- Institutional Control Inspections
- Five-year Site Reviews

Alternative III-3, is designed to reduce potential human-health risks associated with contaminated soil and groundwater at the Area 3 upland and wetland. This alternative would consist of excavating approximately 120 cy of contaminated soils to protect unrestricted-use (residential) receptors from soil exposure and implementing institutional controls to protect possible future-use (commercial/industrial) and unrestricted-use (residential) receptors from groundwater exposures. Wetland protection, environmental monitoring and 5-year site reviews would be would be performed at the site as discussed for Alternative II-3.

The estimated 30-year NPW cost to implement Alternative III-3 is $387,000. A cost sensitivity analysis revealed that a reduction in sampling duration, institutional controls

and site reviews to only 7 years (assuming groundwater cleanup by natural processes occurs within 7 years) and 33 percent reduction in the estimated quantity of soil requiring excavation decreases the NPW cost to $252,000. A 33 percent increase in the estimated quantity of soil requiring excavation increases the 30-year NPW cost to $395,000.

1.0 INTRODUCTION

This Focused Feasibility Study (FFS) Report evaluates candidate remedial alternatives for controlling potential human-health risks posed by contamination that has been detected in soil and groundwater at Area of Contamination (AOC) 57. AOC 57 is located at the former Main Post of Fort Devens, in the town of Harvard, Massachusetts (Figure 1-1). Harding ESE, *A MACTEC Company,* (Harding ESE), formerly Harding Lawson Associates (HLA) prepared this FFS Report as a component of Task Order 001 of Contract DACA31-94-D-0061 with the U.S. Army Corps of Engineers (USACE). This FFS was performed in general accordance with USEPA *Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA* (USEPA, 1988).

Fort Devens was identified for cessation of operations and closure under Public Law 101-510, the Defense Base Realignment and Closure Act of 1990, and was officially closed in September 1996. Portions of the property formerly occupied by Fort Devens were retained by the Army for reserve forces training and renamed the Devens Reserve Forces Training Area (RFTA). Areas not retained as part of the Devens RFTA were, or are in the process of being, transferred to new owners for reuse and redevelopment. AOC 57 is located in an area planned for transfer to the MassDevelopment for industrial/trade related development and recreation/open space.

1.1 PURPOSE AND SCOPE

The purpose of this FFS Report is to develop, screen, and evaluate remedial alternatives to reduce potential human-health risk posed by contamination in surface and subsurface soil, and groundwater at AOC 57. The Final Remedial Investigation (RI) Report recommended these three media for potential remedial action under CERCLA (HLA, 2000). The recommendation was made as a result of human health and ecological risk assessments described in the RI Report.

Details regarding the nature and distribution of contaminants, as well as the human-health and ecological risk assessments, are presented in the Final RI Report (HLA, 2000). Summaries of RI results, including physical and chemical characterizations, and risk assessments at AOC 57 are presented in this FFS Report. A site conceptual model describing the hydrogeology and chemical environment of the site also is included in this report.

1.2 Report Organization

The FFS Report is based on the nature and distribution of contaminants, and human-health and ecological risk assessments, presented in the Final RI Report (HLA, 2000) and consists of seven sections. Section 1.0 introduces the FS report, its purpose, and the topics the report addresses. Section 1.0 also briefly describes the FS process so the reader has an understanding of the process when reviewing relevant sections of the report. A brief background description of AOC 57, including site location, history, geology, and hydrogeology, is also summarized in Section 1.0.

Section 2.0 summarizes previous site investigations and the contamination assessment for each medium of concern as well as human-health and ecological risks associated with each medium. Section 2.0 also presents a site conceptual model for AOC 57 that considers the interrelationships of contaminant source areas, site geology, site hydrogeology, contaminant persistence, and contaminant distribution.

Section 3.0 identifies the basis for remediation. This section links the results of the risk assessments to the selection of remedial technologies by identifying remedial response objectives and preliminary remediation goals, developing remedial action objectives (RAOs), and listing the resultant general response actions. This section initiates the risk-management decision process.

Section 4.0 identifies remedial technologies for the corresponding response actions, and assembles these technologies into remedial alternatives. Section 5.0 screens these remedial alternatives against the criteria of implementability, effectiveness and cost.

Section 6.0 provides a detailed analysis of the retained alternatives and evaluates each alternative against the first of seven evaluation criteria listed in the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (USEPA, 1990). Section 7.0 presents a comparison of the retained alternatives that are the focus of the detailed evaluation, highlighting the relative advantages and disadvantages of the alternatives with respect to the seven evaluation criteria.

Figures, tables and appendices are presented at the end of this document.

1.3 Feasibility Study Process

The AOC 57 FFS process, as described in this subsection, from remedial action objective identification through detailed analysis of remedial alternatives, is consistent with USEPA RI/FS guidance (USEPA, 1988). The initial steps of the conventional FS process consist of:

- establishing RAOs to reduce actual or potential risks to human health at AOC 57;
- identifying the types of response actions for each media necessary to achieve the RAOs;
- identifying and screening specific remedial technologies that may be capable of attaining RAOs; and
- assembling the selected representative technologies into alternatives which represent a range of treatment and containment combinations as appropriate, and screening these alternatives with respect to the criteria of effectiveness, implementability, and cost. Components considered for each of the three screening criteria are presented in Figure 1-2.

This report follows the above process except that the assembly of alternatives is focused using a more limited set of potential technologies than the selection and assembly of a broad-brush spectrum of technologies in a conventional FS. Preparation of an FFS streamlines the evaluation process and was agreed upon between the Army and the regulatory agencies considering the remaining extent and location of residual contamination following the several removal actions that have already been performed at the site.

Following assembly and screening of the remedial alternatives, this FFS report presents a detailed analysis and comparison of the retained alternatives. Retained alternatives are analyzed in detail using criteria suggested in the RI/FS guidance (USEPA, 1988) and presented in Table 1-1. Based on the results of the detailed analysis, the remedial alternatives are compared to facilitate selection of a preferred alternative or alternatives for AOC 57 remediation.

1.4 BACKGROUND

This subsection presents a brief description and history of AOC 57 and a summary of the site hydrology, geology and hydrogeology interpretations presented in the RI Report.

1.4.1 Site Description and History

The former Fort Devens is located in the towns of Ayer and Shirley (Middlesex County) and Harvard and Lancaster (Worcester County), approximately 35 miles northwest of Boston, Massachusetts. It lies within the Ayer, Shirley, and Clinton map quadrangles (7½-minute series). The property occupies approximately 9,260 acres and was previously divided into the North Post, the Main Post, and the South Post. AOC 57 is located between Barnum Road and Cold Spring Brook on the northeast side of what was formerly the Main

Post (Figure 1-1). It is in an area of the former Fort Devens that has been used primarily for the storage and maintenance of military vehicles.

AOC 57 consists of three subsites (Area 1, Area 2, and Area 3) located south to southeast of Buildings 3713, 3757 and 3758 (Figure 1-3). These areas historically received storm water runoff and wastes from vehicle repair at former vehicle storage yards associated with Buildings 3713, 3757 and 3758. The vehicle storage yards associated with Buildings 3757 and 3758 were abandoned in 1998, and the pavement and fencing were removed. The former storage yards are now soil and grass-covered areas.

Areas 1, 2, and 3 include an upland area (elevations between 228 and 240 ft mean sea level [msl]) that slopes downward to a delineated wetland area (elevations lower than 228 ft msl). At Area 2 the wetland boundary is located approximately 250 feet from Cold Spring Brook, and at Area 3 the wetland boundary is located approximately 500 feet from Cold Spring Brook. The upland area is forested with trees and scrub brush. The wetland area is densely vegetated with brush and contains small areas of standing water.

1.4.1.1 Area 1. A storm drain outfall that collects rainfall from the paved areas around Building 3713 was designated Area 1 (Figure 1-4). The runoff from the paved area into the storm drain system flows to the outfall at Area 1, and eventually into Cold Spring Brook.

On February 13, 1977, Fort Devens personnel at Building 3713 noticed No. 4 fuel oil flowing from an overfilled underground storage tank (UST) into a nearby storm drain (Biang et al., 1992; DFAE, 1977). An estimated 50 to 100 gallons of oil entered Cold Spring Brook through the Area 1 outfall. Containment dikes and absorbent booms were set up across Cold Spring Brook adjacent to Area 2, and approximately 3,000 gallons of mixed oil and water were recovered from the swamp (DFAE, 1977).

Area 1 was investigated and addressed as part of the Area Requiring Environmental Evaluation (AREE) 70 (ADL, 1994), the Groups 2 & 7 Site Investigation (SI) (ABB-ES, 1995a), the Lower Cold Spring Brook SI (ABB-ES, 1995b), and the Study Area (SA) 57, Area 1 Contaminated Soil Removal (Weston, 1998). Following a 1997 contaminated soil removal to address total petroleum hydrocarbons (TPHC) and polycyclic aromatic hydrocarbons (PAHs) contamination, Area 1 was recommended for no further action (NFA); the decision is to be formalized in the AOC 57 Record of Decision (ROD). In accordance with recent USEPA requirements for site closure, a no further action decision must be supported by the demonstration that a site does not pose an unacceptable risk for future unrestricted land use. An assessment of risks was performed as part of the RI. The assessment indicates that there are no unacceptable risks for future unrestricted land use (Refer to Appendix N-1 of the RI Report [HLA, 2000]). Therefore, all further discussions within this FFS will pertain only to Areas 2 and 3.

1.4.1.2 Area 2. Area 2 is located 800 feet northeast of Area 1, and adjacent to a vehicle

storage yard associated with the motor repair shops located in former Buildings 3757 and 3758. The nearby former Building 3756 served as a mess hall and was later converted to a general storehouse. This area formerly consisted of an eroded drainage ditch created by periodic rain runoff. The area has since been regraded and a permanent drainage swale has been installed. Runoff drains into the swale and discharges east to Cold Spring Brook.

The formerly eroded drainage ditch at Area 2 was investigated following detection of naphthalene and TPHC in surface soils during a 1993 site investigation. Subsequent sampling confirmed the presence of TPHC and PAHs in surface soil. In addition, these classes of compounds were also detected in sediment samples from Cold Spring Brook, although the distribution of these contaminants did not indicate that AOC 57 was the source. Additionally, topographic relief in the spill area and Area 2 is such that the oil could not have flowed overland to Cold Spring Brook. Based on the results of these investigations, the Army performed a soil removal action at Area 2 in 1994 (Figure 1-4). Approximately 1,300 cubic yards of soil were excavated. During the removal action, it was discovered that the soil and groundwater contamination were more widespread than expected. The soil removal was stopped and AOC 57 Area 2 was administratively transferred to the RI/FS process. At the completion of the removal action, the area was regraded and a permanent drainage swale was installed (Figure 1-5). Results of sampling conducted during and at the completion of the removal action in 1994 indicated the presence of TPHC, polychlorinated biphenyls (PCBs), lead, and volatile organic compounds (VOCs) in soil and/or groundwater at the site.

1.4.1.3 Area 3. Area 3 is located approximately 600 feet to the northeast of Area 2, south of former vehicle maintenance motor pools and north of the Cold Spring Brook floodplain. The site is characterized by a historic garage and vehicle waste disposal area. The RI was prompted in 1995 and 1996 to address soil staining observed in historical photos.

1.4.2 Site Hydrology

The most significant hydrological feature near AOC 57 is Cold Spring Brook, which originates in the central part of the former Main Post at Devens. Its headwaters are formed by runoff and groundwater discharge in the vicinity of the former Ammunition Storage Point and Cold Spring Brook landfill off Patton Road. Further downstream, it flows north through woodlands and wetlands and passes beneath the B&M Railroad right-of-way at Barnum Road. From there the brook is fed by runoff and groundwater discharge from the former Army property south of Barnum Road. It is at this point that the brook passes to the south of AOC 57 (Figure 1-1). The brook continues to flow northeast off Devens property where it ultimately discharges to Grove Pond. The portion of the brook that is located south and southeast of Barnum Road has been designated Lower Cold Spring Brook and was the subject of the Lower Cold Spring Brook Site Investigation (ABB-ES, 1995b).

Lower Cold Spring Brook is characterized by a four to six-feet wide meandering stream

channel surrounded by 20 to 60 feet of scrub and emergent cattail marsh. Downstream from AOC 57 Area 2, the stream channel becomes poorly defined and dendritic flow paths become more predominant. The 1977 earthen containment dike located immediately south of AOC 57 Area 2 is not believed to have caused ponding of the brook. Observations of flow through the southern portion of the dike indicate that flow is not significantly impeded. In addition, the emergent marshes are of equal width immediately upstream and downstream of the containment dike instead of just upstream as would be expected if ponding were occurring.

Precipitation runoff in the vicinity of AOC 57 Area 2 is controlled primarily by topography and the drainage ditch that runs roughly north to south through Area 2 (Figures 1-4 and 1-5) that eventually discharges to the Cold Spring Brook wetlands.

Area 3 precipitation runoff is primarily northwest to southeast as dictated by the topography. Runoff occurs in eroded channels that are 0.5 to 1 foot deep. Runoff discharges and infiltrates in the Cold Spring Brook flood plain and upper portion of the wetlands. There is no direct surface runoff from Area 3 to the Cold Spring Brook stream channel.

1.4.3 Site Geology

This subsection presents a summary of descriptions of the geologic formations encountered at AOC 57 Areas 2 and 3. Figures 1-5 and 1-6 show the orientations of the geologic cross sections. Figures 1-7 through 1-10 present geologic cross sections A-A' through D-D', respectively. Boring logs and results of grain size analysis are presented in Appendices A and J of the RI Report, respectively.

Geology at both Area 2 and Area 3 is comprised of fill materials overlying native sandy soils. The fill materials above the floodplain (228-foot topographic contour) at Area 2 are comprised of reworked gravelly sand and silty sand 0.5 to 2 feet in thickness overlying a 2 to 6-inch thick discontinuous ash and coal layer. The fill layers reach a maximum observed thickness of 3 feet at the break in slope above the floodplain.

Floodplain deposits consist of 1 to 4 feet of silty sand and silt overlying black organic soils, which are 1-inch to 1-foot thick and laterally discontinuous.

Fill materials at Area 3 are comprised primarily of reworked sand and silty sand, garage waste, and construction debris. The fill layer reaches a maximum observed thickness of 6 feet at test pit 57E-95-24X. Surficial debris was observed within the floodplain south of the 225-foot topographic contour. The vegetation of the floodplain area is scrub oak, maple and brush while 150 feet to the east the vegetation turns to mature pine. The change in vegetation is also coincident with the eastern extent of the surficial debris. Subsurface soil was observed to be comprised of fine to medium, tan to gray, poorly graded sand near the

northern portion of the site (57E-95-21X through 57E-96-31X). Floodplain deposits consist of loose to medium dense, gray, fine silty sands as observed in monitoring well borings 57M-96-10X through 57M-96-13X. Native soils area overlain by a sandy organic layer approximately 1-foot thick.

Bedrock was not encountered in any of the borings at either Area 2 or 3. The bedrock in the vicinity of AOC 57 has been classified as the Berwick Formation. The formation is described as thin- to thick-bedded metamorphosed calcareous metasiltstone, biotitic metasiltstone, and fine-grained metasandstone, interbedded with quartz-muscovite-garnet schist and feldspathic quartzite (Zen, 1983; Robinson and Goldsmith, 1991). Depth to bedrock is assumed to be approximately 100 feet below ground surface (bgs). This is based on the known depth to bedrock of 137.5 feet bgs at the Grove Pond well triplet located in the Massachusetts National Guard property approximately 2,000 feet to the north-northeast.

1.4.4 Hydrogeology

This subsection presents data and interpretations of hydrogeologic conditions at AOC 57 Areas 2 and 3. Water level elevations at Area 2 were measured on December 7, 1995, March 26, 1996, July 23, 1996, January 15, 1997, June 2, 1997, and September 23, 1998. Water level elevations at Area 3 were measured on January 15, 1997, June 2, 1997, and September 23, 1998. In-situ hydraulic conductivity results are described in detail in the RI Report and summarized below.

Groundwater at AOC 57 Areas 2 and 3 occurs in the overburden aquifer (Figures 1-7 through 1-10). Flow directions are predominately from the north-northwest to the south-southeast with local variations occurring as groundwater discharges to Cold Spring Brook. Figures 1-11 and 1-12 present interpreted water table elevation contours for Area 2 based on the January 15, 1997 and September 23, 1998 data sets, respectively. Figures 1-13 and 1-14 present interpreted water table elevation contours for Area 3 based on the January 15, 1997 and September 23, 1998 data sets, respectively. Upward vertical gradients were observed in the piezometer pair 57P-95-01A/57P-95-01B at Area 2 during each groundwater level measurement round near Cold Spring Brook. Small downward vertical gradients were measured at the monitoring well pair 57M-95-08A / 57M-95-08B which is located at a greater distance from the brook. This same scenario is believed to hold for Area 3.

The marsh is a local groundwater discharge area and the effects of this are seen as depressed water levels in the adjacent floodplain at Area 2 and a convergence of flowpaths towards the marsh. The depression adjacent to the marsh, and therefore the convergence of flowpaths, is more pronounced during low water levels. The depressed water levels also indicate that the containment dike is not causing ponding of Cold Spring Brook. Deeper overburden wells were not installed at AOC 57 Area 3, but data from Area 2 suggests that groundwater discharges to Cold Spring Brook and its associated wetlands. The presence of surface water in depressions in the Area 3 floodplain further

suggests that groundwater discharge is occurring.

Groundwater in the surficial aquifer at Devens has been assigned to Class I under Commonwealth of Massachusetts regulations. Class I consists of groundwaters that are "found in the saturated zone of unconsolidated deposits or consolidated rock and bedrock and are designated as a source of potable water supply" (314 Code of Massachusetts Regulations [CMR] 6.03).

1.4.4.1 Horizontal Gradients. The geometric mean of horizontal hydraulic gradients calculated for all data sets at Area 2 range between 0.0095 feet per foot (ft/ft) (December 7, 1995) and 0.013 ft/ft (July 23, 1996). The geometric mean of calculated horizontal hydraulic gradients at Area 3 ranged between 0.022 ft/ft on January 15, 1997 and 0.015 ft/ft on September 23, 1998.

1.4.4.2 Hydraulic Conductivity. In-situ hydraulic conductivity tests were performed on 15 groundwater monitoring wells at AOC 57. Estimates of hydraulic conductivity at Area 2 as calculated by the Bouwer and Rice method range between 1.2×10^{-1} centimeters per second (cm/sec) (2.4×10^{-1} feet per minute (ft/min) and 4.2×10^{-4} cm/sec (8.3×10^{-4} ft/min) at 57M-95-01X and 57M-95-08A, respectively. The geometric mean of the monitoring wells hydraulic conductivities was calculated as 1.7×10^{-2} cm/sec (3.3×10^{-2} ft/min). Estimates of hydraulic conductivity at Area 3 as calculated by the Bouwer and Rice method range between 5.6×10^{-3} cm/sec (1.1×10^{-2} ft/min) and 6.9×10^{-4} cm/sec (1.4×10^{-4} ft/min) at 57M-95-03X and 57M-96-10X, respectively. The geometric mean of the monitoring wells hydraulic conductivities was calculated as 1.8×10^{-3} cm/sec (3.5×10^{-3} ft/min). In general, hydraulic conductivities are greater in the northern portion of the site and decrease as the soils grade finer in the floodplain. The hydraulic conductivity test results are presented in Appendix F of the RI Report.

1.4.4.3 Flow Velocity. Flow velocities were estimated for AOC 57 Areas 2 and 3 using maximum, minimum, and mean horizontal hydraulic gradients and hydraulic conductivities as determined by the Bouwer and Rice method (calculations are provided in Appendix F of the RI Report). An overburden porosity of 30 percent was assumed for the predominately sandy soils for both areas.

At Area 2, the maximum groundwater flow velocity was estimated at 14 feet per day (ft/day) and the minimum flow velocity was calculated as 0.038 ft/day. A flow velocity of 1.56 ft/day was calculated using the geometric mean of observed hydraulic conductivity and horizontal gradients. At Area 3, the maximum groundwater flow velocity was estimated at 1.2 ft/day. A minimum flow velocity of 0.14 ft/day was calculated for the water table. A flow velocity of 0.34 ft/day was calculated for Area 3 using the geometric mean of observed hydraulic conductivity and horizontal gradients. The moderately fast groundwater flow velocities at both areas are consistent with the type of soil (sand) observed at this AOC.

2.0 SITE CHARACTERIZATION

This section presents a brief summary of the previous investigations and removal actions conducted at AOC 57, the current contamination assessment and site conceptual model, and summary of the resultant human health and ecological risk assessments which are presented in the RI Report (HLA, 2000).

2.1 SUMMARY OF PREVIOUS INVESTIGATIONS AND REMOVAL ACTIONS

The following subsections summarize previous investigations and removal actions performed by Devens contractors at AOC 57. The text discussion of previous investigation is provided chronologically. This information is presented to demonstrate the rationale for subsequent removal actions or investigations at the site. A complete presentation and assessment of the analytical data for previous investigations is presented in the RI Report. The scope of each investigations' activities is summarized in Table 2-1 of this FFS Report.

2.1.1 1992 Site Investigations

HARDING ESE conducted an SI at Areas 1 and 2 of AOC 57 (then SA 57) in September 1992. The objective of the SI was to determine the presence or absence of environmental contaminants at AOC 57 as a result of the February 1977 fuel oil spill. A detailed description of the results of the SI are presented in the Revised Final Groups 2, 7, and Historic Gas Station SI Report (ABB-ES, 1995a).

Samples of surface soil, surface water, and sediment were collected from Areas 1 and 2 during the SI. PAHs and TPHC possibly associated with fuel oil were detected in surface soils at Area 1. However, the Preliminary Risk Evaluation (PRE), which was conducted to evaluate potential exposure to detected PAH compounds and TPHC, indicated that there was no unacceptable risk for commercial/industrial site reuse. The Army recommended that Area 1 be further investigated as part of the installation-wide AREE 70 storm sewer study (ADL, 1994).

At Area 2, naphthalene and TPHC were detected in surface soils during the SI. Fingerprint analysis of soil from Area 2 indicated that contaminated soil was most likely derived from lubricating oil, possibly from the release of vehicle crankcase oil. Given this finding, the contaminants found at Area 2 are not likely related to the 1977 release of No. 4 fuel oil. Results of the human-health and ecological PREs indicated that the chemical hazards at Area 2 were not significant. However, the PREs were performed prior to promulgation of applicable MCP standards.

Surface water and sediment samples were collected during the SA 57 SI as well as during

the Group 3 SI conducted in June of 1992. Analyses of these samples showed similar levels of VOCs, semivolatile organic compounds (SVOCs), TPHC, and various inorganics in both the upstream and downstream samples. Based on these data it was concluded that SA 57 may have impacted sediment quality in Cold Spring Brook. However, analytical results showed that additional contamination was entering Cold Spring Brook from a source further south (upstream). This was further investigated during the AREE 70 investigation and the Lower Cold Spring Brook SI.

2.1.2 AREE 70 Investigation

The AREE 70 investigation (ADL, 1994) gathered information on 55 storm drain systems and three surface water bodies, and identified potential sources of contamination that were not identified through previous investigations. Included in the AREE 70 evaluation was Storm Drain System 6 (AOC 57 Area 1). Analyses of the surface water and sediment samples for this system indicated elevated levels of arsenic, chromium, and lead in sediment and arsenic and lead in water. SVOCs were also detected at a maximum total SVOC concentration of 59.8 milligrams per kilogram (mg/kg). Results of the sampling were incorporated into the Lower Cold Spring Brook Study ecological PRE (see Subsection 2.1.4).

2.1.3 Area 2 Soil Removal Activities

The PREs performed in conjunction with the 1992 Groups 2 and 7 SI indicated that chemical hazards at Areas 1 and 2 were not significant. However, the PREs were performed just prior to promulgation of MCP soil standards. In consideration of the new standards, the Army proposed that a limited soil removal (focused on TPHC) be conducted at Area 2.

In October of 1993 eight additional surface soil samples were collected from the drainage ditch area and screened for TPHC to aid in determining the extent of contamination requiring removal. A removal action performed by OHM began on August 26, 1994 and continued until September 12, 1994. Soil was excavated using standard excavating equipment. Soil samples were collected for field analysis of TPHC as each area was excavated. TPHC was detected in these samples up to a maximum concentration of 74,208 mg/kg. Black, oily soil was detected at approximately 18 inches bgs at the base of the slope.

Continued excavation efforts revealed stained soil laterally and at depths in excess of original estimates. An approximate 80-foot long trench was excavated to the water table in the southern-most portion of Area 2 to define the extent of contamination (Figure 1-4). An oily sheen was observed on water in the trench.

The trench was not successful in determining the limits of contamination, so 17 test pits

were subsequently excavated outside the previously excavated area. Soils collected from the test pits were field-screened to determine the extent of TPHC-contaminated soil. Soon after starting the test pit excavation, it became clear that contamination extended well beyond the limits originally estimated, and the removal action was suspended until Area 2 could be better characterized. Approximately 1,300 cubic yards of soil was ultimately excavated from Area 2, before it was lined with 6-mil polyethylene, backfilled with clean soil, and covered with an erosion control blanket. A drainage swale was constructed and lined with 6-inch riprap to channel surface water runoff to the Cold Spring Brook wetland. Subsequently, SA 57 Area 2 was administratively transferred to the RI/FS process and redesignated AOC 57.

2.1.4 Lower Cold Spring Brook Study

In 1994, HARDING ESE conducted an SI at Lower Cold Spring Brook to evaluate surface water and sediment quality. Samples were collected from 23 locations in Lower Cold Spring Brook and 11 locations in storm drain ditches and swales. A portion of the SI surface water and sediment samples were collected from Cold Spring Brook at locations both upstream and downstream of AOC 57 Areas 1, 2, and 3 (Figure 1-4). The findings of this SI were presented in the "Lower Cold Spring Brook SI Report" (ABB-ES, 1995b).

The SI produced no evidence that analytes in surface water pose risks to aquatic receptors. Furthermore, no ecological risks were identified from exposure to contaminated media in several of the storm drain systems including system No. 6 (AOC 57 Area 1). No further study was recommended for Area 1.

Analytical results from the brook in the vicinity of Area 2 indicated that the marsh located upstream of the 1977 containment dike contained sediments with elevated concentrations of VOCs, SVOCs, pesticides, PCBs, and inorganics (Figure 1-4). TPHC was detected at a maximum concentration of 2,700 mg/kg. SVOCs were detected at concentrations that marginally exceeded screening values, while pesticides, PCBs, and inorganics significantly exceeded screening values. Lead was detected in surface water at a concentration above the Ambient Water Quality Criteria (AWQC). Pesticides and the maximum concentrations of inorganics in sediment were found in the sample adjacent to AOC 57 Area 2. The ecological PRE showed no risks to aquatic receptors from surface waters. However, limited ecological risks may be associated with AOC 57 marsh sediments. Relative to the control area, this station contained the poorest habitat. However, macroinvertebrate and aquatic toxicity results did not indicate any increased mortality relative to aquatic receptors.

As a result, it was recommended that Lower Cold Spring Brook in the vicinity of AOC 57 Area 2 be further evaluated during the RI.

2.1.5 Area 1 Contaminated Soil Removal

The reader is referred to the RI Report for details regarding this excavation which commenced in February of 1997. The RI risk assessment indicates that there are no unacceptable risk for future unrestricted land use at Area 1 and as a result, the focus of this FFS pertains only to Areas 2 and 3.

2.2 RI CONTAMINATION ASSESSMENT SUMMARY

Based upon the conclusions and recommendations of the previous investigations an RI was planned and performed at AOC 57. RI field work at AOC 57 proceeded in three phases:

- Initial RI field work in the Fall of 1995;
- Modification of field work in the Fall of 1996; and
- Supplemental Investigation in the Spring of 1998.

The Fall 1995 field work focused primarily on Area 2; however, based upon historical photos which suggested soil staining, several test pits, TerraProbe points, and a monitoring well were installed in an area approximately 600 feet to northeast of Area 2. The explorations showed that this was the site of historical disposal of vehicle maintenance waste. The site was designated AOC 57 Area 3 and became the subject of the Fall 1996 field investigation.

The Draft RI Report was issued following the Fall 1996 field investigation. As a result of regulatory comments additional sampling was performed in 1998 at Areas 2 and 3. The purpose of the 1998 supplemental sampling was to further delineate the downgradient extent of contamination. A summary of investigation activities completed during the RI is presented in Table 2-1. Locations of RI explorations are presented in Figures 1-5 and 1-6.

The RI sampling at AOC 57 Areas 2 and 3 consisted of:

- collection of 16 sediment and 11 surface water samples from Cold Spring Brook near Area 2, and five surface water and sediment samples from the Cold Spring Brook Flood plain at Area 3;

- excavation of 23 test pits at Area 2 (57E-95-01X through 57E -95-20X and 57E-95-25X through 57E-95-27X) and eight test pits at Area 3 (57E-95-21X through 57E-95-24X and 57E-96-28X through 57E-96-31X);

- drilling and sampling of six soil borings at Area 2 (57B-95-01X through 57B-95-06X) and six soil borings at Area 3 (57B-96-07X through 57B-96-12X);

- soil and groundwater sampling of 20 TerraProbe[SM] points installed at Area 3 (57R-95-01X through 57R-95-06X and 57R-96-07X through 57R-96-20X);
- collection of surficial and subsurface soil samples from 10 locations at Area 2 and from six locations at Area 3;
- two rounds of groundwater sampling from nine new monitoring wells (57M-95-01X, 57M-95-02X, 57M-95-04A, 57M-95-04B, 57M-95-05X, through 57M-95-07X, 57M-95-08A, and 57M-95-08B) and two existing monitoring wells (G3M-92-02X and G3M-92-07X) at Area 2;
- one round of groundwater sampling from six new monitoring wells (57M-95-03X and 57M-96-09X through 57M-96-13X) and one existing monitoring well (G3M-92-07X) at Area 3; and
- one round of sampling from the piezometers at Areas 2 and 3 and monitoring well 57M-96-11X

As a result of the data obtained from the RI investigation, a contaminated soil removal action was performed at AOC 57 Area 3. The removal action, which focused on PCBs and extractable petroleum hydrocarbons (EPH) in soil, was performed in three phases between March and June of 1999. A total of 1,860 cubic yards of soil were removed from Area 3. Confirmatory soil samples were collected from the excavation bottom and walls to help direct the excavation.

The following subsections summarize the nature and distribution of detected analytes presented in the AOC 57 RI Report (HLA, 2000). The following summary of the RI results is presented by media: soil, groundwater. Because the risk assessments performed as part of the RI found no significant risks associated with sediment and surface water, summaries of the analytical results for these two media have been excluded from the following subsections. Refer to the RI Report for discussion pertaining to surface water and sediment.

The results of the 1999 Area 3 Soil Removal Action confirmatory sampling is presented following the RI analytical results discussion.

2.2.1 Summary of Soil Impacts

The following subsections summarize the analytical soil results for samples collected at AOC 57 Areas 2 and 3 during the RI. Field analytical soil data are presented in Table 2-2 (test pit samples), Table 2-3 (soil boring and TerraProbe samples) and Table 2-5 (surface soil samples). Off-site laboratory analytical soil data are presented in a hits-only format in Table 2-4 (test pit and boring samples) and Table 2-5 (surface soil samples). Complete field analytical and off-site laboratory analytical soil data are presented in Appendix M of the RI

Report. Soil analytical results are discussed separately for Area 2 and Area 3.

2.2.1.1 Area 2. Soil contamination at Area 2 can be divided into two types, 1) surficial contaminants, primarily petroleum hydrocarbons, in the northern portion of the site and 2) higher levels of VOCs, SVOCs, PCBs, and petroleum hydrocarbons in surface and subsurface soils along the southern portion of the soil removal excavation.

Elevated levels of TPHC were observed up to 7,970 mg/kg in the surficial sample from soil boring 57B-95-02X located in the flat, northern portion of the site above the treeline. Other detected contaminants included low levels of SVOCs, pesticides, and PCBs.

The most significant contamination encountered during the 1995 RI efforts was located around the southern portion of the soil removal excavation from the test pit 57E-95-07X to 57E-95-12X at depths ranging from the ground surface to the water table at 4 to 5 feet bgs. Detected VOCs include toluene, ethylbenzene and xylenes (TEX), 1,2-DCE (cis and trans), trichloroethene (TCE), and PCE. The highest off-site laboratory levels of VOCs were observed in 57E-95-07X in 4 feet bgs with total TEX of 0.344 mg/kg, 0.0039 mg/kg of 1,2-DCE, 0.011 mg/kg of TCE, and 0.0059 mg/kg of PCE. The primary SVOCs encountered were naphthalene and methylnaphthalene. The 4 feet bgs sample from 57E-95-07X contained the highest concentration of total SVOCs at 12 mg/kg. Elevated levels of pesticides and PCBs were also observed. Detected pesticides included dieldrin at a maximum observed concentration of 0.032 mg/kg in the surficial sample from 57E-95-17X, 4,4 DDE at 0.00928 mg/kg in the same sample, and Endosulfan I at 0.081 mg/kg in the 2-foot bgs sample from 57E-95-16X. Maximum observed concentrations were 3.2 mg/kg of Aroclor-1248 and 12 mg/kg of Aroclor-1260 both from the 2-foot bgs sample from 57E-95-16X. High levels of TPHC were coincident with the VOC detections. Notable off-site laboratory detections include 31,800 mg/kg in the 4 feet bgs sample from 57E-95-07X, 5,110 mg/kg in the surficial sample from 57E-95-12X, 26,100 mg/kg in the 2 feet bgs sample from 57E-95-15X, 30,000 mg/kg in the 2 feet bgs sample from 57E-95-16X, and 2,390 mg/kg in the surficial sample from 57E-95-17X. Field and off-site analytical results for TPHC concentrations in soil are depicted on Figure 2-1.

The 1998 soil sampling aided in defining the southern extent of the petroleum hydrocarbon contamination south of the Removal Action Excavation. TPHC and/or EPH results from 57S-98-04X, 57S-98-08X, 57S-98-09X, and 57S-9810X all showed decreased concentrations compared to upgradient explorations. Elevated EPH concentrations were observed in the area to the southwest of the Removal Action and at 57S-98-06X. The 1998 field and off-site analytical results for TPHC and EPH concentrations in soil are depicted on Figure 2-2.

A comparison of 1998 EPH results and TPHC results showed that EPH results were much lower than TPHC results from the same sample with respect to the MCP screening values. This suggests that the TPHC data may be artificially high due to interference with organic

material in the soils or potential biogenic sources.

Elevated levels of arsenic were detected in surficial samples coincident with the petroleum hydrocarbon contamination. Arsenic concentration was highest, at 61.2 mg/kg, in the 0-foot sample from 57S-98-07X.

Data gathered during the RI as well as previous investigations suggests that the contaminated soils are due to the historical disposal of vehicle maintenance related wastes. Contaminant distributions indicate that the disposal occurred along the break in slope above the floodplain. Contaminants in surficial soils then percolated/leached into subsurface soils and groundwater where they were transported hydrogeologically downgradient and resorbed to subsurface soils. Contaminants to the south and southeast of the removal action excavation do not appear to be migrating toward the wetland. Contaminant distributions do show that petroleum hydrocarbons and chlorinated VOCs appear to have migrated toward the wetland southwest of the excavation.

2.2.1.2 Area 3. Soil sampling of test pits, TerraProbes^{SM}, and soil borings at Area 3 indicated that concentrations of soil contaminants were highest in the area bounded by test pit 57E-95-24X to the north and the soil boring 57B-96-07X to the south. A historic disposal site located from the surface to approximately 5 feet bgs was defined by test pits 57E-96-28X through 57E-96-31X. Advective transport and sorption appears to have aided in the southerly migration of soil contamination.

The most significant observed soil contaminants included the SVOCs naphthalene, 1,2-dichlorobenzene (1,2-DCB), and 1,4-DCB. Within soil borings, the 5-foot bgs sample from 57B-96-07X contained 31.3 mg/kg of total SVOCs including 8 mg/kg of 1,2-DCB, 2 mg/kg of 1,4-DCB, 9 mg/kg of 2-methylnaphthalene, and 9 mg/kg of naphthalene. Within the test pits, the bulk of the detections occurred in the 10 feet bgs sample from 57E-96-28X. Detected SVOC analytes consist of 1,2,4-trichlorobenzene at 0.5 mg/kg, 1,2-DCB at 6 mg/kg, 1,4-DCB at 4 mg/kg, 2-methylnaphthalene at 0.4 mg/kg, fluoranthene at 1 mg/kg, fluorene at 0.3 mg/kg, chrysene at 1 mg/kg, naphthalene at 2 mg/kg, phenanthrene at 0.4 mg/kg, and pyrene at 3 mg/kg.

Elevated levels of PCBs in soil were encountered in proximity to the source area. The highest observed concentration of PCBs, 3.6 mg/kg of Aroclor-1248 and 10 mg/kg of Aroclor-1260, was found in 57E-95-24X at 4 feet bgs.

Elevated levels of TPHCs were observed coincident with the SVOC contamination. TPHC was detected in all of the Area 3 test pit soil samples at concentrations ranging between 64,900 mg/kg at 57E-95-24X and 262 mg/kg at 57E-96-29X. Petroleum fingerprinting performed on samples collected in 1996 showed that all samples were below detection limits for the gasoline, diesel, and aviation gas patterns. Five soil boring samples were shown to contain measurable levels of TPHC. Three of these samples contained levels in

excess of 100 mg/kg; the surficial sample from 57B-96-07X contained 41,400 mg/kg, the 5 feet bgs sample from the same boring contained 31,600 mg/kg, and the 5 feet bgs sample from 57B-96-11X was found to contain 4,250 mg/kg. Petroleum fingerprinting of the soil samples indicated that the TPHC contamination was consistent with a motor oil pattern. Field analytical results for TPHC concentrations in soil at Area 3 are depicted on Figure 2-3.

Soil sampling performed in 1998 further defined the downgradient extent of the soil contamination. Downgradient soils showed decreasing levels of petroleum hydrocarbons, VOCs, SVOCs, and arsenic.

A comparison of EPH and TPHC results showed that EPH values were significantly lower than TPHC results from the same sample. This suggests that the TPHC data may be artificially high due to interference with organic material in the soils or potential biogenic sources. The 1998 field analytical results for TPHC and EPH concentrations in soil at Area 3 are depicted on Figure 2-4.

2.2.2 Summary of Groundwater Impacts

The following subsections summarize the groundwater analytical results for water samples collected from TerraProbe^{SM} borings and monitoring well borings as well as the off-site laboratory analytical results for the three rounds of RI groundwater sampling (two rounds at Area 2 and one round at Area 3). Field analytical results are provided in Tables 2-6 and 2-8. Off-site laboratory analytical results (Rounds 1 and 2 sampling) are presented in Table 2-7. Complete field analytical and off-site laboratory analytical soil data are presented in Appendix M of the RI Report. Groundwater quality is discussed separately for Area 2 and Area 3.

2.2.2.1 Area 2. Identified Area 2 groundwater contaminants include 1,2-DCE, TCE, PCE, and toluene. As with the soil contamination, the contamination is localized around the southern perimeter of the soil removal excavation. Monitoring well 57M-95-04A generally contained the highest observed concentrations of these compounds; 3.6 µg/L of 1,2-DCE (cis and trans) in the Round 1 sample, 1.9 µg/L of TCE in the Round 2 sample, and 16 µg/L of PCE in the Round 2 sample. PCE was detected in both Rounds 1 and 2 at 57M-95-07X located approximately 140 feet west of the excavation. Groundwater contamination in the vicinity of the soil removal excavation contained lower concentrations of toluene than the upgradient samples in 57M-95-01X. Round 1 and Round 2 VOC detection data are shown in Figure 2-5.

No SVOCs, other than probable laboratory contaminants, were identified in Area 2 groundwater. Endosulfan in the Round 1 sample from 57M-95-06X was the only pesticide detected in groundwater.

The only Area 2 TPHC detection, 356 µg/L, occurred in the Round 1 sample from the upgradient well 57M-95-01X.

2.2.2.2 Area 3. Area 3 groundwater contamination occurs primarily from the source area located immediately north of 57M-95-03X to the furthest most downgradient monitoring well 57M-96-11X. Contaminants observed in this area include inorganics, VOCs and SVOCs. Figures 2-6 and 2-7 show field and off-site analytical detections for the 1996 sampling event, respectively.

During 1996 sampling, cadmium and arsenic were detected at levels in excess of MCLs, cadmium at 8.67 µg/L in 57M-95-03X and arsenic at 170 µg/L in the primary and duplicate samples from 57M-96-11X. Arsenic concentrations decreased dramatically in the piezometers located downgradient of 57P-96-11X.

Additional groundwater sampling was performed at Area 3 in May of 1998. Samples were collected from the piezometers 57P-98-03X and 57P-98-04X, as well as the monitoring well 57M-96-11X. The inorganic analytes arsenic, barium, copper, lead, and manganese were detected in the unfiltered samples at levels in excess of established Devens background concentrations. Arsenic was the only analyte to exceed background concentrations in the filtered sample. The highest concentration of arsenic detected in an unfiltered sample was 84.4 in a duplicate sample collected from 57M-96-11X. The filtered samples collected from 57M-96-11X contained higher levels of arsenic, 138 µg/L in the duplicate sample. The primary sample from 57M-96-11X contained comparable arsenic concentrations, 84.4 µg/L in the unfiltered sample and 133 µg/L in the filtered sample. Total suspended solids (TSS) in the unfiltered sample were 2,120,000 µg/L. Arsenic levels in the piezometers were significantly lower, 13.4 µg/L and 20.9 µg/L in the unfiltered and filtered samples collected from 57P-98-03X and 7.7 µg/L and 12.7 µg/L in the unfiltered and filtered samples collected from 57P-98-04X. The reason for the uniform increase in arsenic concentrations from the unfiltered to the filtered samples is not known. All other inorganic analyte concentrations decreased from the unfiltered to the filtered samples.

During 1996 sampling VOCs were detected in 57M-95-03X, 57M-96-11X, 57M-96-12X, and 57M-96-13X. Toluene was found in all of these samples with a maximum concentration of 19 µg/L in 57M-95-03X. Toluene, at 1.1 µg/L, was the only VOC detected in 57M-96-12X. 57M-96-13X contained toluene at 2.9 µg/L, ethylbenzene at 2.8 µg/L, and the only detection of styrene with 8 µg/L. Chlorinated solvents comprised the majority of the detections in 57M-95-03X and 57M-96-11X. 57M-95-03X contained 4.5 µg/L of carbon tetrachloride, 10 µg/L of chloroform, 2.9 µg/L of dichloromethane, 0.59 µg/L of TCE, 2.6 µg/L of PCE, as well as 46 µg/L of ethylbenzene and 200 µg/L of xylenes. 57M-96-11X contained 0.89 µg/L of 1,2-DCE (cis and trans), 1.1 µg/L of TCE, and 4.8 µg/L of PCE. This sample also contained 0.86 µg/L of toluene, 4.6 µg/L of ethylbenzene, and 6.8 µg/L of xylenes. The majority of VOC detections occurred in 57M-96-11X during the 1998 sampling event. PCE was detected at 5.5 µg/L, TCE at 3.8 µg/L, ethylbenzene at 20 µg/L,

and xylenes at 5.8 µg/L. Two VOCs were detected in 57P-98-03X, ethylbenzene at 3.2 µg/L, and xylenes at 5.7 µg/L. Chlorobenzene at 0.88 µg/L was the only VOC detected in 57P-98-04X.

SVOCs detected during 1996 sampling consisted of 1,2-DCB, 1,4-DCB, and naphthalene. The majority of SVOC detections occurred at 57M-95-03X and 57M-96-11X. 57M-95-03X, located immediately downgradient of the identified source area contained 9.8 µg/L of 1,2-DCB, 5.6 µg/L of 1,4-DCB, 4.4 µg/L of 2-methylnaphthalene, 1.5 µg/L of 4-methylphenol, and 20 µg/L of naphthalene. The duplicate sample from 57M-96-11X, the furthest -most downgradient well contained 3.4 µg/L of 1,2-DCB, 3.3 µg/L of naphthalene, and 6.7 µg/L of bis(2-ethylhexyl)phthalate (BEHP). Other SVOC detections include 5 µg/L of methylphenol in 57M-96-13X and 12 µg/L of BEHP in the sample from the upgradient well G3M-92-07X. Five SVOCs were detected in the 1998 Area 3 groundwater samples. The most detections occurred in 57P-98-03X which contained BEHP at 52 µg/L, 1,2-DCB at 4.9 µg/L, 2-methylnaphthalene at 2 µg/L, and naphthalene at 13 µg/L. 57M-96-11X contained detectable levels of three SVOC compounds: 1,2-DCB at 6.4 µg/L, 1,4-DCB at 2.7 µg/L, and naphthalene at 6.2 µg/L.

No pesticides, PCBs, TPHC or EPH fractions were detected in Area 3 groundwater.

All three volatile petroleum hydrocarbons (VPH) carbon ranges were detected in the sample collected from 57M-96-11X during 1998 sampling. The C5 and C8 aliphatic range was detected at 91 µg/L, the C9 to C12 aliphatic range at 75 µg/L, and the C9 to C10 aromatic range at 250 µg/L (duplicate sample). The highest concentration of aromatics, 310 µg/L, was detected in 57P-98-03X. This was the only VPH fraction detected in this sample.

2.3 Area 3 Soil Removal Action

A contaminated soil removal was performed at AOC 57 Area 3 in the spring of 1999. Data collected during the RI showed that a historic garage waste disposal site approximately 40 feet square by five feet in depth was acting as a source of soil and groundwater contamination. Advective transport appears to have aided in the southerly migration of soil contamination. Removal activities were conducted in accordance with the Action Memorandum for AOC 57, Area 3 (HLA, 1999).

2.3.1 Excavation/Sampling Sequence

Soil excavation was performed with an extended-reach, tracked excavator. Prior to excavation a soil berm was constructed and a silt fence was erected on the southern side of the excavation to prevent migration of contaminated soils or siltation of the Cold Spring Brook wetland. The source area removal was conducted in phases based on results of confirmatory samples collected from the excavation bottom and sidewalls.

Confirmatory samples were analyzed at an off-site laboratory for pesticides/PCBs and EPH/VPH. In addition, while soils were being excavated, samples were collected for photoionization detector (PID) headspace analysis to aid in directing the excavation. The extent of the excavation and location of confirmatory samples are provided in Figure 1-6.

2.3.1.1 Phase I. The initial soil removal action was completed between March 22 and March 25, 1999. Existing landmarks including monitoring wells and historic sample locations were used as reference points to identify the boundaries of the excavation. The excavation began at the southern end of the source area (near soil boring 57B-96-07X) and moved north. The excavation reached a depth of approximately 5 feet in the southern portion and 10 feet in the north. Phase I of the source area removal action yielded approximately 1400 cubic yards of contaminated soil and debris. A total of ten confirmatory samples, eight sidewall (EX57W01X through EX57W08X) and two bottom samples (EX57F01X and EX57F02X), were collected for off-site analysis.

2.3.1.2 Phase II. Phase I confirmatory sampling indicated that residual PCB contamination was present in two of the samples (EX57W03X and EX57F01X) at levels in excess of MCP S-2/GW-3 standards but below the risk based goal for subsurface soils of 4 mg/kg. The PCB detections were located at the southern extent of the excavation. In response to these results a second phase of the soil removal action was conducted on April 15 and 16, 1999. The Phase II excavation was started approximately 50 feet south of the existing excavation and was extended north to the previous excavation. The width of the excavation in this area was approximately 12 feet, the same as the southern tongue of the previous excavation. In addition, the southwestern wall of the previous excavation was expanded approximately three feet to the west. The phase II excavation was approximately three feet deep in the southern end and approximately 5 feet deep at the northern end where it joined the Phase I excavation.

A total of six confirmatory samples were collected from within the excavation including five wall samples (EX57W09X through EX57W13X) and one bottom sample (EX57F03X). A total of 320 cubic yards of material was removed during this phase of the soil removal action.

The results of the Phase II confirmatory samples indicated that elevated concentrations of PCBs and EPH were present on the southern wall of the excavation. Therefore, on May 26, 1999 PCB immuno-assays were used to delineate the area of residual PCB contamination. Samples were collected from eleven location using a hand auger. The sample locations were within two to six feet of the excavation and the samples were collected from one to three feet bgs. Some of the locations were sampled at multiple depths.

2.3.1.3 Phase III. Based upon the results of the PCB screening and the Phase II confirmatory sampling, additional excavation was performed in the area extending

laterally two feet around the southern tongue of the excavation. No additional material was removed from the bottom of the excavation in this area. Four confirmatory samples were collected from the sidewalls. An additional 140 cubic yards of soil was removed during the Phase III excavation.

In total, 1860 cubic yards of soil was removed during the Area 3 soil removal. The contaminated soil was stored adjacent to Barnum Road. The soil was placed on poly-sheeting, and covered with reinforced poly-sheeting. Straw bales were placed around the covered soil pile to prevent runoff to the surrounding area.

2.3.2 Confirmatory Sampling Results

Confirmatory soil samples were collected from the excavation walls and bottom following each of the three phases of excavations. The soil samples were submitted for off-site analysis for EPH/VPH, pesticides, and PCBs. The following section summarizes the results of the confirmatory sampling and discusses the residual soil contamination at Area 3. Confirmatory sampling results are provided in Table 2-9 and sampling locations are shown in Figure 1-6.

VPH carbon ranges were detected along the eastern and western walls of the southern tongue of the excavation. The highest concentrations were detected along the western wall approximately 40 feet north of the southern terminus of the excavation where EX57W16X at 2 feet bgs was shown to contain 890 mg/kg of C9 to C12 aliphatics and 600 mg/kg of C9 to C10 aromatics. Elevated VPH levels were also found in EX57W14X which contained 52 mg/kg of the C9 to C12 aliphatics and 55 mg/kg of the C9 to C10 aromatics.

Elevated levels of EPH were found at 1 to 2 feet bgs along the southern extent of the excavation. The highest concentrations were found in EX57W14X which contained 920 mg/kg of C9 to C18 aliphatics, 20,000 mg/kg of C19 to C36 aliphatics, and 3,100 mg/kg of C11 to C22 aromatics. EX57W15X and EX57W16X also contained high levels of EPH aliphatic and aromatic ranges.

The pesticides dieldrin, endrin, and 4,4'-DDD were found coincident with the EPH detections in the southern portion of the excavation. Dieldrin was found at 2 feet bgs in EX57W14X and EX57W16X at 0.14 mg/kg and 0.086 mg/kg, respectively. EX57W16X was the only sample to contain endrin 0.07 mg/kg. Low levels of 4,4'-DDD, 0.24 to 0.29 mg/kg were detected at 1 to 2 feet bgs in EX57W15X, EX57W16X, and EX57F01X.

Residual PCB contamination was detected at 2 feet bgs in EX57W14X at 4.3 mg/kg. PCBs were also detected in the bottom sample EX57F01X at 2.6 mg/kg. PCB detections consisted of the congener Aroclor-1260.

Residual contamination is located at 1 to 2 feet bgs in the southern portion of the excavation in the vicinity of EX57W14X, EX57W15X, and EX57W16X. The Removal Action showed that the soil contamination was primarily confined to a subsurface zone of eluviated organic silty sand varying in thickness from 2-inches to 1-foot. This layer varied in depth from three to five feet in the northern source area to 1-foot in the southern extent of the excavation.

2.4 AREA 3 VERTICAL GROUNDWATER SCREENING

Groundwater sample collection and screening was performed in June of 2000 to address regulatory agency requests for further delineation of deep groundwater quality based primarily upon low levels of PCE (5 μg/L) detected in the downgradient water table monitoring well 57M-96-11X. The vertical profiling of groundwater would indicate whether chlorinated VOCs have migrated vertically downward from the source area or are potentially being transported at depth.

Two small diameter sampling points, each having a five foot screen, were advanced and sampled at 10-foot intervals starting at the water table (2.5 feet bgs at 57N-00-01X and 14 feet bgs at 57N-00-02X) and continuing to completion depths of 58 feet bgs for the downgradient exploration 57N-00-01X and 79 feet bgs for 57N-00-02X located upgradient of the source area (Figure 1-6). Attempts were made to sample deeper intervals at 57N-00-01X, however increasing silt content within the aquifer prevented sample collection. The purpose of 57N-00-01X was to determine if PCE detected in 57M-96-11X is a reflection of contaminants being transported at depth. The other sampling point, 57N-00-02X was installed north (upgradient) of the soil removal excavation to determine if there is an upgradient source of groundwater contamination.

Groundwater samples were collected for analysis at an on-site laboratory for PCE, TCE, DCE, 1,2-DCB, and 1,4-DCB. MADEP representatives collected split samples for off-site analysis for VOCs by USEPA Method 8260B.

2.4.1 On-Site Screening Results

Six samples were collected for on-site screening from the downgradient location 57N-00-01X. No target compounds were detected in any of these samples (Table 2-10).

Seven samples were collected for on-site screening from 57N-00-02X located approximately 25 feet upgradient of the previously excavated Area 3 source area. The only detection of PCE, 1 μg/L, was from the sample collected from 34-39 feet bgs. TCE was detected at 12.4 μg/L in the sample collected at 54-59 feet bgs. No other target compounds were detected. Based upon the depth of these detections and their upgradient location, these contaminants are not believed to be attributed to the Area 3 source area.

2.4.2 Off-Site Analytical Results

All six samples collected from 57N-00-01X were split with MADEP representatives. Results of MADEP's analysis showed that the first two samples collected, 3-8 feet bgs and 13-18 feet bgs, contained low levels of numerous VOCs (Table 2-11). Both the number of detections and the concentrations of individual contaminants, except PCE, decreased with depth. PCE was not detected in the 3-8 feet bgs sample but was detected in the 13-18 feet bgs sample at 4.8 μg/L. The presence of VOCs in these first two samples is attributed to residual contamination that had collected on surface water in the excavation. The only other detections were PCE at 0.88 μg/L in the 23-28 feet bgs sample, this value is below the method reporting limit of 2 μg/L. Methylene chloride was detected in all but two of the 10 samples analyzed. Acetone and methyl ethyl ketone were both detected in the 3-8 feet bgs sample in 57N-00-01X but were below detection limits in all other samples. Methylene chloride, acetone and methyl ethyl ketone are all suspected laboratory contaminants.

Four of the seven samples collected from 57N-00-02X were split with MADEP. Split samples were from the 14-19 feet bgs, 54-59 feet bgs, 64-69 feet bgs and 74-79 feet bgs intervals. TCE was detected in two of these samples, 17 μg/L in the sample from 54-59 feet bgs and 1.4 μg/L in the 74-79 feet bgs sample. PCE was detected at 1 μg/L in the 54-59 feet bgs sample only.

2.5 SITE CONCEPTUAL MODEL

Figure 2-8 presents a simplified site conceptual model encompassing the essential features of AOC 57 Areas 2 and 3 and showing the potential source and transport mechanisms for the contaminants detected at AOC 57. The model reflects the current understanding of the site with respect to sources of contamination, the distribution of contamination, and the potential migration pathways.

Based on the results of the RI, the primary site-related contaminants at AOC 57 are solvent and fuel-related contaminants in soil and groundwater. VOCs, SVOCs, pesticides, PCBs, and TPHC were detected during the investigation.

Based on the results of the field investigation, the interpreted Area 2 contaminant source was contaminated surface and near surface soils located in the vicinity of the soil removal excavation. The soil contamination is believed to be due to disposal of vehicle maintenance wastes. The Area 3 contaminant source is the historic disposal site identified by test pitting at 57E-95-24X.

The primary release mechanism at both areas was infiltration into groundwater from source area contaminants above the water table. Potential secondary release mechanism is the contaminated soil downgradient of the source areas. The contaminated soil downgradient

of the source areas is believed to be due to sorption of dissolved phase contaminants.

The primary migration pathway/transport mechanism is groundwater flow of dissolved contaminants.

2.6 Baseline Human Health Risk Assessment Summary

Possible health risks at AOC 57 were evaluated for the following land uses:

- current land uses: site maintenance worker (upland area), recreational child (wetland area)
- possible future land uses: commercial/industrial workers (upland area) and construction workers (upland and wetland areas)
- unrestricted future land uses: adult and child residents (upland and wetland areas)

The current land use at AOC 57 may best be described as idle. There are no active military operation or land-redevelopment near AOC 57. The majority of the AOC is forested and densely vegetated, and access in difficult. There is no specific reason to visit the AOC, and there are no nuisance or curiosity attractions. The wetland area is muddy; any standing surface water is not deep enough or aesthetically pleasing. Therefore, it is unlikely that any people would be present at, or access AOC 57 under the existing land use conditions. Although the site is presently not used and is not located near any properties with active land uses, exposures and risks for current site use were evaluated for a site maintenance worker (possible exposure to surface soil in the upland portion of the site), and a recreational child ages 6 through 16 (possible exposure to surface soil, surface water, and sediment in the wetland portion of the site).

The possible future site and surrounding land use conditions at AOC 57 were assumed to be commercial/industrial in the upland areas, and open space/recreational in the wetland areas. AOC 57 is located within an area designated for "Rail, Industrial, Trade-Related, and Open Recreational" in the Devens Reuse Plan (Vanasse Hangen Brustlin, 1994). Construction of buildings in the delineated wetland area or use of this area for anything other than open space is not realistic. However, the future use of the wetland area could include constructing designated trails for passive recreational use (e.g., bird watching). Therefore, under the future land use, it is possible that recreational visitors and construction workers could access the wetland areas. The possible health risks associated with the future site use, assuming that the upland portion of the site will be redeveloped for commercial/industrial use, included evaluation of a commercial industrial worker (possible exposure to surface soil and groundwater) and an excavation worker (possible exposure to surface soil and subsurface soil).

In addition, to aid in risk management decision-making and to determine if additional

response actions may be required at AOC 57, unrestricted future land use was evaluated by assuming that child and adult residents would live at the upland and wetland areas of the site (possible exposures to surface and subsurface soils, and groundwater). Since groundwater at and beneath AOC 57 is not used as a source of drinking or industrial water, and the vicinity is serviced by potable water mains, evaluation of potable groundwater use represents a hypothetical worst-case evaluation of potential exposures and risks.

The risk assessment evaluated post-removal action conditions for surface soil and subsurface soil. Chemicals of potential concern (CPCs) identified in surface soil and subsurface soil primarily included arsenic, iron, manganese, PCB, and petroleum compounds such as EPH and VPH hydrocarbon fractions. CPCs identified in groundwater, surface water, and sediment were similar to those identified in soil, but also included chlorinated VOCs, which were detected at low concentrations. Petroleum compounds and PCBs are interpreted to be directly associated with the release of oils and vehicle maintenance wastes to soils at the site. Inorganic constituents selected as CPCs are interpreted to be indirectly associated with the petroleum release. The natural degradation of petroleum contaminants has caused reducing conditions in the aquifer, which in turn results in enhanced leaching of naturally-occurring inorganics from source area soils.

Table 2-12 presents a summary of the risk estimates. Possible health risks were quantified for carcinogenic and noncarcinogenic effects, for both reasonable maximum and central tendency exposure assumptions. Estimated cancer risks associated with current land use conditions are within the Superfund carcinogenic risk range established by the USEPA (defined as $1x10^{-4}$ to $1x10^{-6}$ excess carcinogenic risk). Noncancer risks associated with current land use are below the noncarcinogenic hazard index (HI) of 1 (defined as the threshold target value typically applied by USEPA to evaluate the significance of noncancer risks.) Estimated cancer risks associated with future open space use of the Area 2 wetland areas of the site were within the Superfund risk range established the USEPA. However, risks associated with potential future excavation of Area 2 wetland subsurface soils exceeded an HI of 1. These noncancer risks were primarily attributable to PCBs detected in soil samples at the toe of the Area 2 soil removal excavation. With the exception of potable use of Area 3 groundwater, estimated cancer and noncancer risks associated with future commercial/industrial development and use of upland areas of the site were within the risk ranges and target values established by the USEPA. The noncancer risk for commercial/industrial potable use of groundwater at the Area 3 is a HI of 2, which exceeds the threshold HI of 1. Since groundwater at AOC 57 is not currently used for potable water and the vicinity is serviced by public water mains, potable use exposures are unlikely to occur. A more realistic potential use of AOC 57 groundwater is for industrial process water. However, it is unlikely that non-potable industrial uses of groundwater would result in an exposure scenario which would result in levels of risk that exceed the USEPA risk range or target level.

Estimated noncancer risks associated with unrestricted land use exposures to soil at upland and wetland portions of Area 2 and Area 3 exceed the USEPA target level. The noncancer risk at the Area 2 wetland area is primarily associated with PCBs, chromium, petroleum hydrocarbons and arsenic. However, the noncancer risks at the Area 2 upland area and Area 3 wetland area are primarily associated with petroleum hydrocarbon contamination. As noted in Table 2-10, the total HI shown for the upland Area 2, child resident exposure scenario for surface soils is 2. Following USEPA risk assessment guidance, when a HI exceeds 1, it is appropriate to consider the toxicological endpoints upon which the noncarcinogenic hazards are based and the target organs for toxicological effects. Hazard indices for individual compounds should properly be added together only if the toxicological endpoints or mechanisms of action of the compounds are similar. In the case with the upland Area 2 child resident exposure scenario, the target-organ specific HIs are less than or equal to the USEPA target threshold value of 1 for noncancer risks, as calculated in Appendix N-6, Table 5 of the Final RI Report (HLA, 2000). Cancer risks associated with potential unrestricted land use exposures to soil at Areas 2 and 3 do not exceed the USEPA cancer risk range.

Estimated cancer and noncancer risks associated with unrestricted land use of groundwater at AOC 57 exceed USEPA risk levels. However, evaluation of risks associated with potable use represent a hypothetical scenario; future commercial or residential development at AOC 57 would likely be supplied with municipal water.

Based on the conclusions of the risk assessment, health risks associated with the current and possible future use of the following media at AOC 57 are within or below USEPA's established risk range/target level:

- Area 2 upland soil and wetland surface soil
- Area 2 wetland surface water and sediment
- Area 3 upland and wetland soil
- Area 3 wetland surface water and sediment
- Area 3 upland groundwater

The noncancer risk associated with future commercial/industrial potable use of Area 2 upland groundwater slightly exceeds the USEPA threshold level. However, potable use of AOC 57 groundwater is not expected, since Devens is supplied with municipal water. The noncancer risk associated with excavation of Area 2 wetland subsurface soil exceeds the USEPA threshold level; risks are primarily attributable to PCBs is located within 50 feet south and east of the former excavation area.

Based on the conclusions of the risk assessment, human health risk values associated with unrestricted land use of soil and groundwater at AOC 57 exceed USEPA's risk range and threshold level.

The soil removal actions at AOC 57 significantly reduced petroleum contamination in soil, thereby mitigating possible exposures to petroleum-related CPCs and mitigating the leaching of naturally-occurring inorganics. Therefore, the risk estimates presented in this risk assessment for groundwater are worst-case estimates that are unlikely to be exceeded under anticipated future land use conditions.

2.7 BASELINE ECOLOGICAL RISK ASSESSMENT SUMMARY

Potential risks for ecological receptors at AOC 57 were evaluated for CPCs in surface soil, surface water, sediment, and groundwater using benchmarks from the literature and site-specific data (e.g., toxicity test results, bioaccumulation study results, and measurement of fish and crayfish tissue concentrations). The following exposure pathways were evaluated in the Baseline Ecological Risk Assessment (BERA):

- food chain risks to terrestrial and semi-aquatic mammals and birds that occur in the upland, forested floodplain, and open stream/marsh areas;
- direct contact risks to aquatic receptors (e.g., plants, invertebrates, amphibians, and fish) exposed to surface water and sediment; and
- direct contact risks to terrestrial plants and soil invertebrates exposed to surface soil.

Based on the results of the AOC 57 BERA, there does not appear to be significant adverse affects to ecological receptors. Based on a comparison of surface water data with upgradient groundwater data, Cold Spring Brook surface water in the vicinity of Area 2 may be impacted by groundwater discharge. However, there does not appear to be a risk to aquatic receptors from the chemicals common to both these media. Groundwater at Area 3 does not appear to be impacting downgradient surface water in the floodplain of Cold Spring Brook, based on the difference in chemicals detected in these media. Details of the BERA are contained in the RI Report (HLA, 2000).

3.0 BASIS FOR REMEDIATION

This section presents the basis for remediation at AOC 57, and includes the following information:

- identification of remedial response objectives
- identification of applicable or relevant and appropriate requirements (ARARs)
- development of preliminary remediation goals (PRGs)
- development of RAOs
- assessment of the extent of contamination exceeding PRGs
- identification of general response actions

Collectively, this information provides the rationale for remediation and the basis for developing and comparing remedial technologies and alternatives. Establishing remedial response objectives focuses the feasibility study on those media of concern. ARARs are used in this section to aid in identifying COCs and to evaluate the appropriate extent of site clean-up. In subsequent sections of the FFS, ARARs will be used in defining and formulating remedial action alternatives and will govern implementation and operation of the selected action. PRGs are developed based on chemical-specific ARARs and computed risk-based concentrations (RBCs) and are used to develop the RAOs for each media of concern. RAOs form the basis for identifying general response actions and remedial technologies and for developing remedial alternatives.

3.1 IDENTIFICATION OF REMEDIAL RESPONSE OBJECTIVES

Remedial response objectives are site-specific qualitative cleanup objectives used for defining RAOs and for developing appropriate remedial alternatives. They are developed based on the nature and distribution of contamination, the resources currently or potentially threatened, and the potential for human and environmental exposure. At AOC 57, remedial response objectives for each medium of concern (i.e., soil and groundwater) were developed based on the human-health risk assessment results. Remedial response objectives were identified for media and land use scenarios where the risk assessment revealed potential risks greater than the target risk range of $1x10^{-4}$ to $1x10^{-6}$ and noncancer HI greater than 1. As detailed in the RI Report (HLA, 2000) and summarized in Section 2.0 of this FFS Report, the baseline ecological assessment revealed that there were no significant adverse affects to ecological receptors. Although current-use exposure scenario risks were within USEPA's target risk range and below a HI threshold value of 1, the human-health risk assessment did identify a number of possible future and unrestricted use exposure scenarios with risk levels that exceeded these values.

3.1.1 Areas/Media With Site Risk Exceeding USEPA Target Risk Range and Threshold Value

Table 2-12 summarizes the results of the human-health risk assessment and identifies those areas and media that present cancer risk greater than $1x10^{-4}$ and noncancer risk with HI greater than 1. Based on the human-health risk characterization, the following areas/media were recommended for an FS:

Area 2 - Possible Future Use Scenario:

Construction worker exposure to wetland subsurface soil (noncarcinogenic risk).

Area 2 - Unrestricted Use Scenarios:

Child residential exposure to wetland surface soil (noncarcinogenic risk).

Child residential exposure to wetland subsurface soil (noncarcinogenic risk).

Adult residential exposure to wetland groundwater (noncarcinogenic and carcinogenic risks).

Area 3 - Possible Future Use Scenario:

Commercial/industrial worker exposure to upland groundwater (noncarcinogenic and carcinogenic risks).

Area 3 - Unrestricted Use Scenario:

Child residential exposure to wetland surface soil (noncarcinogenic risk).

Adult residential exposure to upland and wetland groundwater (noncarcinogenic and carcinogenic risks).

3.1.2 Remedial Response Objectives

Based on the risk characterization and conceptual model presented in the RI Report (HLA, 2000), the following remedial response objectives for AOC 57 were formulated:

Area 2

Possible Future Use

- Protect potential receptors working within Area 2 wetlands from ingesting

contaminated subsurface soils.

Unrestricted Use

- Prevent potential residential receptors from coming in dermal contact and ingesting contaminated surface soils within Area 2 wetlands.
- Prevent potential residential receptors from coming in dermal contact and ingesting contaminated subsurface soils within Area 2 wetlands.
- Prevent residential ingestion of contaminated groundwater within Area 2 wetlands.

Area 3

Possible Future Use

- Protect potential commercial/industrial receptors from ingesting contaminated groundwater from the Area 3 uplands.

Unrestricted Use

- Prevent potential residential ingestion of contaminated groundwater from the Area 3 uplands and wetlands .
- Prevent potential residential receptors from coming in dermal contact and ingesting contaminated surface soils within the Area 3 wetlands.

3.2 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

CERCLA, Superfund Amendments and Reauthorization Act (SARA), and the NCP require that ARARs be identified during the development of remedial alternatives. ARARs are federal and state human health and environmental requirements and guidelines used to (1) evaluate the appropriate extent of site cleanup; (2) define and formulate remedial action alternatives; and (3) govern implementation and operation of the selected action. Only those promulgated state requirements identified by the state in a timely manner that are more stringent than federal requirements may be ARARs.

Section 4.0 of the RI Report provides a complete discussion of ARARs and identifies federal and state requirements that may pertain to remedial responses at AOC 57. Paragraphs that pertain to the identification of COCs and PRGs as performed in this section are reiterated below for convenience to the reader.

3.2.1 Definition of ARAR Categories

To properly consider ARARs and to clarify their function in the RI/FS process, the NCP defines two ARAR components: (1) applicable requirements, and (2) relevant and appropriate requirements. These definitions are discussed in the following paragraphs:

Applicable Requirements - Applicable requirements are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance that have jurisdiction at a site. An example of an applicable requirement is the use of the Safe Drinking Water Act (SDWA) Maximum Contaminant Levels (MCLs) drinking water standards for a site where hazardous substances have caused water in a public water supply to become contaminated.

Relevant and Appropriate Requirements - Relevant and appropriate requirements are cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations that, while not "applicable" to a hazardous substance, pollutant, contaminant, remedial action, location or other circumstance at a site, address problems or situations sufficiently similar to those encountered at the site that their use is well-suited to the particular site. For example, MCLs for drinking water would be relevant and appropriate requirements at a site where hazardous substances are found in or could enter groundwater classified as a current or future drinking water source. When a requirement is found to be relevant and appropriate, it is complied with to the same degree as if it were applicable.

To be Considered (TBC) Information. Non-promulgated advisories or guidance issued by the federal and state government are not legally binding and do not have the status of potential ARARs. However, in many circumstances, TBCs are considered in the absence of ARARs, or along with ARARs as part of the site risk assessment, and may be used in determining the level of cleanup for protection of human health or the environment.

3.2.2 Identification of ARARs for AOC 57

Because of their site-specific nature, identification of ARARs requires evaluation of federal, state, and local environmental and health regulations regarding chemicals of concern, site characteristics, and proposed remedial alternatives. ARARs that pertain to the remedial response at AOC 57 can be classified into three categories: chemical-, location-, and action-specific. The following subsections provide an overview of these ARARs.

3.2.2.1 Chemical-Specific ARARs. Chemical-specific ARARs generally involve health- or risk-based numerical values or methodologies that establish site-specific acceptable chemical concentrations or amounts. These values are used to develop action levels or

cleanup concentrations and govern the extent of site remediation. Tables 4-1 through 4-3 of the RI Report (HLA, 2000) set forth the federal and state chemical-specific ARARs and TBC information for groundwater and soil. These ARARs will be referenced in greater detail in subsequent subsections of this FFS Report pertaining to COC identification and PRG development.

3.2.2.2 Location-Specific ARARs. Location-specific ARARs represent restrictions placed on the concentration of hazardous substances or the conduct of activities because of the location or characteristics of a site. These ARARs set restrictions relative to special locations such as wetlands, floodplains, sensitive ecosystems, as well as historic or archeological sites, and provide a basis for assessing existing site conditions. Table 4-4 of the RI Report lists potential location-specific federal and state requirements. Identification and evaluation of location-specific ARARs is an iterative task, necessary throughout the remedial response process. For instance, some of the location-specific ARARs pertaining to wetlands and floodplains may or may not be applicable, or relevant and appropriate, depending on the remedial action selected because the regulations do not apply unless some activity is conducted in a certain defined area. The potential location-specific ARARs will be refined as the as the media of concern and locations/extents of contamination are defined in the FS process. Location-specific ARARs for each assembled remedial alternative will be identified and discussed in subsequent FFS sections pertaining to the detailed evaluation and comparative analysis of alternatives in Sections 6 and 7, respectively.

3.2.2.3 Action-Specific ARARs. Action-specific ARARs involve design, implementation, and performance requirements that are generally technology- or activity-based. Action-specific ARARs, unlike location- and chemical-specific ARARs, are usually technology- or activity-based limitations that direct how remedial actions are conducted. After remedial alternatives are developed, the evaluation of action-specific ARARs is one criterion for assessing the feasibility and effectiveness of compliance with proposed remedial alternatives. The applicability of this set of requirements is directly related to the particular remedial activities selected for the site. Table 4-5 of the RI Report represents an overview of potential action-specific ARARs that may or may not ultimately be applicable to AOC 57. As with location-specific ARARs, the potential action-specific ARARs will be refined as the response actions are defined in the FS process. Action-specific ARARs for each assembled remedial alternative will be identified and discussed in subsequent FFS sections pertaining to the detailed evaluation and comparative analysis of alternatives in Sections 6 and 7, respectively.

3.2.3 Massachusetts Contingency Plan

The NCP provides that CERCLA response actions must comply with environmental and public-health laws and regulations to the extent they are substantive (i.e., pertain directly to actions or conditions in the environment), but do not need to comply with those that are administrative (i.e., mechanisms that facilitate the implementation of the substantive

requirements).

The provisions of the Massachusetts Contingency Plan (MCP), 310 CMR 40.0000 (MADEP, 1997) are mostly administrative in nature and, therefore do not have to be complied with in connection with the response actions selected for AOC 57 Areas 2 and 3. Further, the MCP contains a specific provision (310 CMR 40.0111) for deferring application of the MCP at CERCLA sites. As stated in the MCP, response actions at CERCLA sites are deemed adequately regulated for purposes of compliance with the MCP, provided the Massachusetts Department of Environmental Protection (MADEP) concurs in the CERCLA Record of Decision (ROD).

3.3 DEVELOPMENT OF PRELIMINARY REMEDIATION GOALS

PRGs are long-term numerical goals used during analysis and selection of remedial alternatives. PRGs should comply with ARARs and result in residual risks consistent with NCP requirements for protection of human health and the environment. Therefore, PRGs are based both on risk-based concentrations and on ARARs. Eventually, PRGs become the final remediation goals for the selected remedy.

3.3.1 PRG Identification Process

PRGs for AOC 57 were developed following the USEPA guidance document entitled *Risk Assessment Guidance for Superfund: Volume 1 - Human Health Evaluation Manual (Part B, Development of Risk Based Preliminary Remediation Goals)*, Interim, December 1991 (RAGS Part E) (USEPA, 1991) and OSWER Directive 9355.0-30, *Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions* (USEPA, 1991b).

The first step in developing human-health PRGs is to identify those environmental media that, in the baseline human-health risk assessment, present either a cumulative current or future cancer risk greater than 1×10^{-4} or a noncarcinogenic target-organ based HI greater than 1, based on reasonable maximum exposure (RME) assumptions. The RME is defined as the maximum exposure that is reasonably expected to occur at a site. It is derived for a given exposure pathway by combining the maximum EPC of each chemical with reasonable maximum values describing the extent, frequency, and duration of exposure. The specific assumptions used in deriving the RME for each exposure scenario are discussed in detail in the RI Report (HLA, 2000). The next step is to identify COCs within the media that present cancer risks greater than 1×10^{-6} or an hazard quotient (HQ) greater than 1. Following identification of media of concern and COCs, PRGs are developed and refined by considering ARARs, exposures, uncertainties and other technical factors.

3.3.1.1 Media of Concern. Table 2-12 and Subsection 3.1.1 summarize the results of the

human-health risk assessment and identify those media that present cancer risk greater than $1x10^{-4}$ and noncancer risk with HI greater than 1. Under assumptions of *current land use* of Areas 2 and 3, the baseline human-health risk assessment did not identify media of concern or CPCs presenting cancer risks or HIs greater than USEPA criteria. However, the risk assessment did identify media that presented cancer risk greater than $1x10^{-4}$ or a noncarcinogenic target-organ based HI greater than 1 under possible future land use and unrestricted future use. These are summarized in the following table.

Media of Concern Summary Areas 2 and 3		
Area	**Possible Future Land Use**	**Unrestricted Land Use**
2	• Wetland Subsurface Soil (Construction Worker Exposure)	• Wetland Surface Soil • Wetland Subsurface Soil • Wetland Groundwater (All Residential Exposures)
3	• Upland Groundwater • (Commercial/Industrial Exposure)	• Upland Groundwater • Wetland Groundwater • Wetland Surface Soil All Residential Exposures)

3.3.1.2 Human-Health COCs: Human-health COCs were identified next for each media of concern. A contaminant was considered a human-health COC if it contributed a cancer risk greater than $1x10^{-6}$ or a HQ greater than 1 under RME assumptions. Subsections 3.3.2 and 3.3.3 identify the human-health COCs by exposure and media of concern. Tables 3-1 and 3-2 summarize the noncancer and cancer risk estimates and list COCs with their respective risk contribution.

3.3.1.3 Comparison to ARARs. CPCs, as identified in the human-health risk assessment, were compared with ARARs for each media of concern. As identified by the RI Report (HLA, 2000), federal ARARs pertaining specifically to groundwater at AOC 57 consist of the USEPA SDWA drinking water standards (USEPA, 1996). The MCLs in these regulations are applicable to contaminants found in public water systems that have at least 15 service connections or serve an average of at least 25 people daily at least 60 days per year. Even when not applicable, MCLs may be relevant and appropriate to groundwater that is a potential source of potable water. State chemical-specific ARARs used in the development of PRGs consist of the Commonwealth of Massachusetts drinking water standards or MMCL (MADEP, 1999). ARAR exceedances are discussed on a groundwater-area-specific basis in Subsections 3.3.2 and 3.3.3. Table 3-4 lists the COCs with their respective maximum detected concentration and ARAR concentration(s) (MCL, MMCL).

There currently are no federal chemical-specific ARARs for soils at AOC 57. RBCs were calculated for each human-health COC to develop PRGs for soil RAOs. If an RBC was not developed following USEPA risk assessment guidance (i.e., such as for lead), the Massachusetts MCP Sections 310 CMR 40.0940 and 40.0974 -0975 pertaining to the MCP Method 1 risk characterization were considered in developing the PRG. The MCP Method 1 establishes specific numerical standards for certain listed contaminants in soil, and where applicable, are listed in Table 3-3.

3.3.1.4 Risk-Based Concentrations. If no chemical-specific ARAR was available for development of a PRG (i.e., such as for soils), RBCs were back-calculated for each COC using the exposure assumptions employed in the RI Report (HLA, 2000). The target cancer risk was set at $1x10^{-6}$ and the target HQ at 1. Appendix A presents the methodology used to calculate the RBCs. PRGs were back-calculated based upon required residual risk. If applicable, the lesser of the RBCs for carcinogenic and noncarcinogenic effects is presented in the column headed RBC in Table 3-3.

3.3.2 PRGs for Possible Future Land Use Scenarios

The following paragraphs identify the human-health COCs, compare CPCs to ARARs, and identify PRGs for each media of concern for possible future land use scenarios. Tables 3-1 and 3-2 summarize the noncancer and cancer risk estimates, respectively and list these COCs with their respective risk contribution. Tables 3-3 and 3-4 present the rationale for selection of the PRGs for soil and groundwater, respectively, based on RBCs and ARAR considerations.

3.3.2.1 Area 2 Recreational (Wetland Area) - Subsurface Soil: Aroclor-1260 was identified as a Human-Health COC in Area 2 wetland subsurface soils for the construction worker exposure scenario. Aroclor-1260 presents a target-organ specific HI greater than 1 (HI of 1.7). Lead concentrations were also compared to the USEPA soil lead screening level in OSWER Directive 93554-12, (USEPA, 1994). The EPC for lead (5,060 mg/kg) exceeded the USEPA residential screening value for lead of 400 mg/kg in only one sample.

There are no ARARs that govern the cleanup of PCBs or lead in soils. The Toxic Substances Control Act (TSCA) 40 Code of Federal Regulations (CFR) 761 contains federal requirements pertaining to the manufacture, use and disposal of PCBs and contains "To Be Considered" Guidance. Subpart D Storage and Disposal of the August 1998 promulgated Disposal Amendments (called the "Megarule" by industry), pertains to the cleanup and disposal options for PCB remediation waste. Section 761.61 of Subpart D specifies self-implementing on-site cleanup levels for soil at less than or equal 1 parts per million (ppm) for high occupancy areas (occupancies with exposures of 335 hours per year; 6.7 hours per week, or more) and less than or equal to 25 ppm for low occupancy areas. The regulations state that the self-implementing cleanup provisions are not binding upon

cleanups conducted under other authorities including Section 104 or Section 106 of CERCLA. Furthermore, Section 761.61(c) permits risk-based disposal methods for PCBs.

Use of the calculated RBC for Arochlor-1260 (3.5 mg/kg) as the proposed PRG for wetland subsurface soils at Area 2 results in a more conservative cleanup estimate than the 40 CFR 761 criteria because it also considers that there are exposures to other contaminants in addition to PCBs.

No USEPA commercial/industrial soil lead screening level currently exists. However, OSWER Directive 9355.4-12 (USEPA, 1994) specifies 400 mg/kg for a residential soil lead screening level. For this reason, the PRG for lead was based upon the MCP Method 1 Risk Characterization S-2/GW-1 Soil Standard of 600 mg/kg. The S-2 standard is applicable to the construction worker scenario where there is potentially accessible soil, the possibility of children exists, and there is low frequency and high intensity for exposure for a construction worker. Only one sampled location at Area 2 (the 5 ft. bgs sample at 57E-95-13X at 5,060 mg/kg lead) exceeded the S-2 standard of 600 mg/kg, or the USEPA residential screening value for lead of 400 mg/kg (see Figure 3-1).

3.3.2.2 Area 3 Industrial (Upland Area) - Groundwater: Arsenic and carbon tetrachloride were identified as Human-Health COCs in Area 3 upland groundwater for the commercial/industrial worker ingestion exposure scenario. Arsenic is the largest contributor (over 98 percent with a contribution of 1.7×10^{-4}) to the total carcinogenic risk from groundwater which is slightly greater than 1.7×10^{-4}. It also presents a target-organ specific HI of 1.1 which contributes to a total HI of 2 for Area 3 upland groundwater. Carbon tetrachloride presents a carcinogenic risk only slightly greater than 1×10^{-6} (2.0×10^{-6}) and contributes only approximately 1 percent to the total carcinogenic risk.

The baseline human-health risk assessment also identified cadmium and 1,4-DCB as COCs in upland groundwater that exceeded federal and Massachusetts drinking water standards. Additionally, arsenic was detected above its MCL of 50 μg/L in the earliest sampling round of November 1995 (but not in subsequent rounds). Proposed PRGs for arsenic, cadmium and 1,4-DCB are based on their respective MCLs and MMCLs, as shown in Table 3-4. It should be noted that the Human-Health COC of carbon tetrachloride did not exceed its MCL/MMCL. Therefore no PRGs were developed for this compound.

BEHP was also detected (at 300 μg/L) above its MCL/MMCL of 6 μg/L in a duplicate sample from 57M-95-03X. However, because the BEHP concentrations in the primary sample in the same round and in the sample collected from the subsequent round were below quantitation limits (4.8 μg/L), BEHP is considered a likely laboratory or sampling contaminant. As detailed in the RI Report, phthalates have been identified by USEPA as common laboratory/sampling contaminants. The RI Report notes that BEHP was detected in water blanks during the 1995 Round 2 groundwater sampling event, and rinse

blanks from the 1996 field investigations. Based on method blank data evaluations, the RI Report also suggests that low concentrations of BEHP detected in 1998 groundwater data may also represent laboratory contamination. As will be discussed in subsequent paragraphs pertaining to Area 2, irregular detections of BEHP have also been noted at upland Area 2 such as a single exceedance of the BEHP MCL/MMCL in the upgradient monitoring well G3M-92-07, suggesting that BEHP is likely a laboratory/sampling artifact and not a site contaminant.

Aluminum, iron, and manganese maximum concentrations (190 μg/L, 12,400 μg/L, and 466 μg/L, respectively), exceeded their respective secondary maximum contaminant level (SMCL) drinking water standards (50 μg/L, 300 μg/L, and 50 μg/L, respectively). SMCLs are non health based, nonenforceable federal and state guidelines regarding aesthetic qualities of drinking water and therefore are not ARARs.

3.3.3 PRGs for Unrestricted Land Use Scenarios

The following paragraphs identify the human-health COCs, compare CPCs to ARARs, and identify PRGs for each media of concern for unrestricted land use scenarios. Tables 3-1 and 3-2 summarize the noncancer and cancer risk estimates, respectively and list these COCs with their respective risk contribution. Tables 3-3 and 3-4 present the rationale for selection of the PRGs for soil and groundwater, respectively, based on RBCs and ARAR considerations.

3.3.3.1 Area 2 Recreational (Wetland Area) - Surface and Subsurface Soil: Arsenic and Aroclor-1260 were identified as human-health COCs in Area 2 wetland *surface* soils for the child resident exposure scenario. Arsenic and Aroclor-1260 each present target-organ specific HIs greater than 1 (HIs of 1.2 and 2.8, respectively).

Aroclor-1260, chromium, and the EPH C11-C22 aromatic carbon range were identified as human-health COCs in Area 2 wetland *subsurface* soils for the child residential exposure scenario. Each contaminant presents a target-organ specific HI greater than 1 (HIs of 9.2, 4.4 and 3.8, respectively). Lead concentrations were also compared to the USEPA soil lead screening level in OSWER Directive 93554-12, (USEPA, 1994). The EPC for lead (5,060 mg/kg) exceeded the USEPA residential screening value for lead of 400 mg/kg in only one sample (57E-95-13X).

As previously discussed, there currently are no federal chemical-specific ARARs which govern the extent of site remediation for soils at AOC 57. (Refer to Subsection 3.3.2.1 for discussion pertaining to PCB cleanup guidance and the Toxic Substances Control Act (TSCA) 40 CFR 761). RBCs were calculated for each human-health COC to develop PRGs for unrestricted land use RAOs. The USEPA OSWER Directive 9355.4-12 (USEPA, 1994) residential screening value of 400 mg/kg was used in the risk assessment as the lead screening level and selected as the PRG for lead. In that the risk characterization was

performed following USEPA guidance, the Method 1 MCP methods (lead standard of 300 mg/kg) was not applied for development of the PRG. PRGs developed for these COCs are presented in Table 3-3.

3.3.3.2 Area 2 Recreational (Wetland Area) - Groundwater: Arsenic, BEHP, tetrachloroethylene (PCE), and Aroclor-1260 were identified as Human-Health COCs in Area 2 wetland groundwater for an adult residential exposure scenario. Arsenic is the only COC that presents a target-organ specific HI greater than 1 (HI of 5), and is the largest contributor (over 92 percent with a contribution of 9.6×10^{-4}) to the total carcinogenic risk of 1×10^{-3} in groundwater. BEHP, PCE, and Aroclor-1260 contribute only approximately 6, 1, and 0.5 percent, respectively, to the overall carcinogenic risk from groundwater ingestion.

The baseline human-health risk assessment also identified wetland groundwater analytes that exceed federal and Massachusetts drinking water standards (Table 3-4). These analytes are arsenic, BEHP, and PCE. Exceedances of MCLs/MMCLs for each compound are depicted on Figure 3-4.

BEHP was detected above its MCL/MMCL (6 μg/L) in three monitoring wells in the wetland area (57M-95-08B, 57M-95-04B, and 57P-98-02X). It should be noted that BEHP also exceeded its MCL/MMCL in the upland monitoring well 57M-95-05X in addition to the upgradient monitoring well G3M-92-07. Besides BEHP being detected in the upgradient monitoring well at Area 2, its irregular detection is noted in 57M-95-04B and 57M-95-08B where concentrations were orders of magnitude greater in 1996 Round 2 (400 μg/L [Area 2 maximum concentration] and 300 μg/L, respectively) than in 1995 Round 1 (5 μg/L and 6.9 μg/L, respectively). Similar irregular detection are noted in Area 2 where BEHP was detected at 300 μg/L in a duplicate sample from 57M-95-03X and below quantitation limits (4.8 μg/L) in the primary sample in the same round and in the sample collected from the subsequent round. As previously discussed, phthalates have identified by USEPA as common laboratory/sampling contaminants. Due to detections within water and rinse blanks and irregular detections at both Areas 1 and 2 at the site, BEHP is considered a likely laboratory or sampling contaminant.

Proposed PRGs for arsenic and PCE are based on their respective MCLs and MMCLs, as shown in Table 3-4. It should be noted that Aroclor-1260 was detected (at 0.22 μg/L) only once above quantitation limits, at only one location (57P-98-02X), and in only one sampling round. This detection is below its MCL and MMCL of 0.5 μg/L. Therefore no PRG was developed for this contaminant.

3.3.3.3 Area 3 Recreational (Wetland Area) - Surface Soil. The EPH C11-C22 aromatic carbon range was identified as the only Human-Health COC in Area 3 wetland surface soils for the child residential exposure scenario. The EPH C11-C22 aromatic carbon range presents a target-organ specific HI greater than 1 (HIs of 1.7).

As previously discussed, there currently are no federal chemical-specific ARARs which govern the extent of site remediation for soils at AOC 57. The MCP provides a Method 1 Risk Characterization S-1/GW-1 Soil Standard of 200 mg/kg for the C11-C22 carbon range. However, because a site-specific risk characterization was performed following USEPA guidance, the calculated RBC for the EPH C11-C22 carbon range (930 mg/kg) is proposed as the PRG for wetland area surface soils at Area 3. Exceedances of this risk-based concentration are shown in Figure 3-5.

3.3.3.4 Area 3 Industrial (Upland Area) – Groundwater. Arsenic, carbon tetrachloride, 1,4-
DCB, and PCE were identified as Human-Health COCs in Area 3 upland groundwater for an adult residential exposure scenario. Arsenic is the only COC that presents a target-organ specific HI greater than 1 (HI of 3), and is the largest contributor (over 98 percent with a contribution of 5.8×10^{-4}) to the total carcinogenic risk of 5.9×10^{-4} in groundwater. Carbon tetrachloride, 1,4-DCB, and PCE contribute only approximately 1.2, 0.3, and 0.3 percent, respectively, to the overall carcinogenic risk from groundwater ingestion.

Refer to Subsection 3.3.2.2 for discussion pertaining to cadmium, arsenic, and 1,4-DCB exceedances of MCLs/MMCL; BEHP as being a suspected laboratory/sampling contaminant; and aluminum, iron, and manganese exceedances of SMCLs. Proposed PRGs for arsenic, cadmium and 1,4-DCB are based on their respective MCLs and MMCLs, as shown in Table 3-4.

3.3.3.5 Area 3 Recreational (Wetland Area) – Groundwater. Arsenic, BEHP, and PCE were identified as Human-Health COCs in Area 3 wetland groundwater for an adult residential exposure scenario. Arsenic is the only COC that presents a target-organ specific HI greater than 1 (HI of 7.7), and is the largest contributor (99 percent with a contribution of 1.5×10^{-3}) to the total carcinogenic risk from groundwater ingestion, which is slightly greater than 1.5×10^{-3}. BEHP and PCE contribute only approximately 0.6 and 0.2 percent, respectively, to the overall carcinogenic risk from groundwater ingestion.

The baseline human-health risk assessment also identified wetland area groundwater analytes that exceed federal and Massachusetts drinking water standards (Table 3-4). These analytes are arsenic, PCE, and BEHP. BEHP was detected at 52 μg/L at 57P-98-03X, which is above its MCL/MMCL of 6 μg/L. As previously discussed in Subsection 3.3.3.2, BEHP is a likely laboratory contaminant. PRGs for arsenic and PCE are based on their respective MCLs/MMCLs, as shown in Table 3-4. PRG exceedances in upland area groundwater are depicted on Figure 3-6.

Aluminum, iron, and manganese maximum concentrations (2,450 μg/L, 1,910 μg/L, and 346 μg/L, respectively), exceeded their respective SMCL drinking water standards (50 μg/L, 300 μg/L, 50 μg/L, respectively). As previously discussed, SMCLs are

nonenforceable federal and state guidelines regarding aesthetic qualities of drinking water and therefore are not ARARs. Also aluminum and iron maximum concentrations are less than background concentrations.

3.4 REMEDIAL ACTION OBJECTIVES

RAOs are site-specific, quantitative goals defining the extent of cleanup required to achieve response objectives. They specify contaminants of concern, exposure routes, receptors, and PRGs. RAOs are used as the framework for developing remedial alternatives. The RAOs are formulated to achieve the overall USEPA goal of protecting human health and the environment. RAOs for AOC 57 are as follows:

Area 2

Possible Future Use Scenario (Construction Worker)

- Protect potential construction workers that might work within future recreational (wetland) areas at Area 2 from ingesting soils containing Aroclor-1260 and lead in excess of PRG concentrations considered protective of human health, as presented in Table 3-3.

Unrestricted Land Use Scenario (Residential)

- Prevent potential residential receptors from coming in dermal contact and ingesting Area 2 wetland soils containing Aroclor-1260, arsenic, chromium, lead, and the EPH C11-C22 aromatic carbon range in excess of PRG concentrations considered protective of human health, as presented in Table 3-3.

- Prevent residential potable use of Area 2 wetland groundwater containing arsenic and PCE in concentrations that exceed MCL and MMCL drinking water standards.

Area 3

Possible Future Use Scenario (Commercial/Industrial Worker)

- Protect potential future commercial/industrial receptors from ingesting upland Area 3 groundwater that contains arsenic, cadmium and 1,4-DCB in concentrations that exceed MCL and MMCL drinking water standards.

Unrestricted Land Use Scenario (Residential)

- Prevent residential potable use of Area 3 upland groundwater containing arsenic, cadmium, and 1,4-DCB in concentrations that exceed MCL and MMCL drinking water standards.

- Prevent residential potable use of Area 3 wetland groundwater containing arsenic and PCE in concentrations that exceed MCL and MMCL drinking water standards.

- Prevent potential residential receptors from coming in dermal contact and ingesting surface soils containing the EPH C11-C22 aromatic carbon range in excess of the PRG concentration considered protective of human health, as presented in Table 3-3.

3.5 EXTENT OF CONTAMINATION EXCEEDING PRGs

This subsection discusses the areal and vertical extent of contamination that exceeds PRGs for each medium of concern at AOC 57. Areal and vertical extents of contamination were developed based on RAOs, available site analytical data, site topography and history, and professional judgement. A confirmation sampling program will be included as a component of remedial alternatives involving soil removal or treatment. Subsections 3.5.1 and 3.5.2 discuss the extent of contamination for Area 2 under possible future use and unrestricted use scenarios, respectively. Subsections 3.5.3 and 3.5.4 discuss the extent of contamination for Area 3 under possible future use and unrestricted use scenarios, respectively.

3.5.1 Area 2 - Possible Future Use Scenario (Construction Worker)

Area 2 wetland subsurface soils contain Aroclor-1260 and lead concentrations in excess of concentrations considered protective of human health. Although the human-health risk assessment defines subsurface soil as extending from 2 to 10 feet bgs, the extent of Aroclor-1260 and lead contamination was evaluated by comparing both subsurface and surface soil analytical data to the remedial action objective in Subsection 3.4, for FFS cost estimating purposes. This evaluation revealed five of 23 sampled locations within the Area 2 wetland soils with an exceedance of PRGs (3.5 mg/kg for Aroclor-1260 and 600 mg/kg for lead). Four locations exceeded the Aroclor-1260 PRG (57E-95-12X, 57E-95-15X, 57E-95-16X, and 57S-98-03X). Lead was detected at concentrations exceeding its PRG in only 57E-95-13X. The estimated areal extent of soil contamination is shown in Figure 3-1 based on these observed PRG exceedances.

Analytical data delineating the vertical extent of contamination are more limited.

However, based upon review of test pit records, a black organic soil layer that in instances was reported as having a septic and fuel like odor, was observed at approximately 1 to 4 feet bgs in three of the four test pits. Two of the three test pit samples with Aroclor-1260 exceedances were obtained from this layer, although the lead PRG exceedance was from approximately 5 feet bgs within a test pit where no black organic layer was observed (57E-95-13X). Groundwater is reported to be at approximately 221 feet mean sea level (MSL) in this area, only 2 to 6 feet bgs. Based upon depth of the organic soil layer, it is assumed for cost estimating purposes that the average depth of contaminated soil would extend down to approximately 4 feet bgs. The estimated in-place volume of soils containing Aroclor-1260 and lead concentrations in excess of PRGs is 640 cy.

3.5.2 Area 2 – Unrestricted Use Scenario (Residential)

3.5.2.1 Area 2 - Wetland Soils. Area 2 wetland surface and subsurface soils contain the following COCs in excess of concentrations considered protective of human health for unrestricted land use scenario: Aroclor-1260, arsenic, chromium, lead, and the EPH C11-C22 aromatic carbon range. For FFS cost estimating purposes, the extent of contamination was evaluated by comparing existing analytical data from surface and subsurface soils to the remedial action objective in Subsection 3.4. This evaluation revealed 11 of 23 sampled locations within Area 2 wetland soils with an exceedance of PRGs (0.5 mg/kg for Aroclor-1260, 21 mg/kg for arsenic, 550 mg/kg for chromium, 400 mg/kg for lead, and 930 mg/kg for the EPH C11-C22 aromatic carbon range). Aroclor-1260 concentrations were in excess of its PRG in six sampled locations (57E-95-12X, 57E-95-15X, 57E-95-16X, 57S-98-02X, 57S-98-03X and 57S-98-07X), primarily located at the south and east periphery of the former excavation area. Arsenic exceeded its PRG in five sampled locations (57S-98-02X, 57S-98-05X, 57S-98-07X [0-foot and 1-foot depths] and 57S-98-09X) also at the south and east periphery of the former excavation area. Lead and chromium PRG exceedances were co-located at the northeast corner of the wetland area in test pit 57E-95-13X at 5-foot bgs. This was the only detection of chromium above its RBC (550 mg/kg) or above background (33 mg/kg) at Area 2.

The EPH C11-C22 aromatic carbon range exceeds its calculated RBC of 930 mg/kg at 990 mg/kg in the 2-foot bgs sample at 57S-98-03X located at the southern end of the former excavation. Although this was the only exceedance of the C11-C22 carbon range PRG, there were several sampled locations with elevated TPH concentrations that are suspected of containing exceedances of the C11-C22 fraction. Appendix N of the RI Report discusses the method used to derive the average percent-composition of each EPH and VPH fraction. The C11-C22 fraction is estimated to be approximately 22 percent of the total TPH at Area 2. As a result, it is assumed for FFS purposes that locations with detected TPHC concentrations greater than 4,195 mg/kg may contain C11-C22 fractions with concentrations that exceed its PRG. TPHC exceeds 4,195 mg/kg in four sampled surface and subsurface locations with 31,800 mg/kg, detected in 57E-95-07X, being the highest

detected concentration. TPHC/C11-C22 exceedances are co-located with the Aroclor-1260 PRG exceedances in four of five locations.

It is also anticipated that exceedances of the C11-C22 PRG are possible in the 57E-95-17X area despite that the 57E-95-17X 0-foot-bgs sample did not reveal COC concentrations exceeding PRGs. Test pit records reveal that the edge of the black organic layer appears in the eastern half of this test pit and below where the off-site analyzed soil sample was collected. PID headspace readings from soils below the sampled location were elevated (22 to 93 ppm) similar to those from test pit 57E-95-07X. Additionally, on-site gasoline range organics (GRO) analysis was 5,800 and 52,000 µg/kg, for the 2-foot and 5-foot-bgs samples respectively. On that basis, it is assumed that exceedances of the C11-C22 fraction PRG is possible in the 57E-95-17X area. The estimated areal extent of soil contamination is shown in Figure 3-3 based on observed and interpreted PRG exceedances.

The assessment regarding the vertical extent of contamination for the Unrestricted Use Scenario is the same as is discussed for the Possible Future Use Scenario (Construction Worker) in Subsection 3.5.1. Based upon depth of the organic soil layer, it is assumed for cost estimating purposes that the average depth of contaminated soil would extend down to approximately 4 feet bgs. The estimated in-place volume of soil containing COC concentrations in excess of PRGs is 1,800 cy.

3.5.2.2 Area 2 - Wetland Groundwater. Area 2 wetland groundwater contains arsenic and PCE in concentrations in excess of PRGs (50 µg/L for arsenic and 5 µg/L for PCE). A review of existing groundwater analytical data shows that PRGs were exceeded for arsenic in 57P-98-02X, and for PCE in 57M-95-04A. 57P-98-02X and 57M-95-04A are screened at or near the water table with 2-foot and 10-foot screens respectively. PRG exceedances are shown in Figure 3-4. As with the soil contaminants, groundwater contamination is generally localized around the southern perimeter of the soil removal excavation. PCE was also detected at concentrations below its PRG in Rounds 1 and 2 at 57M-95-07X screened from 1-1/2 to 11-1/2 feet below the water table and located approximately 140 feet west of the excavation.

3.5.3 Area 3 - Possible Future Use Scenario (Commercial/Industrial Worker)

Area 3 upland groundwater contains cadmium and 1,4-DCB in concentrations in excess of PRGs (5 µg/L for cadmium and 5 µg/L for 1,4-DCB) for the Possible Future Use scenario. A review of existing groundwater analytical data shows that PRGs were exceeded for cadmium and 1,4-DCB at 57M-95-03X at the upland Area 3 (8.67 µg/L for cadmium and 5.6 µg/L for 1,4-DCB in the October 1996 sampling round). There were no exceedances of these compounds in the Area 3 wetland during any groundwater sampling round. 57M-95-03X is screened at the water table with a 10-foot screen. These PRG exceedances are shown in Figure 3-2.

3.5.4 Area 3 – Unrestricted Use Scenario (Residential)

3.5.4.1 Area 3 - Wetland Surface Soils. Area 3 wetland surface soils contain the EPH C11-C22 aromatic carbon range in excess of concentrations considered protective of human health for the Unrestricted Use scenario. For FFS cost estimating purposes, the extent of contamination was evaluated by comparing existing analytical data from surface and subsurface soils to the remedial action objective in Subsection 3.4. This evaluation revealed only three of 14 sampled locations within Area 2 wetland soils with an exceedance of the EPH C11-C22 PRG (930 mg/kg) and no exceedances within upland soils. The PRG exceedances occurred at the three removal action sample locations EX57W14X, EX57W15X, and EX57W16X located at the southern end of the former excavation. The estimated areal extent of soil contamination is shown in Figure 3-5 based on these observed PRG exceedances.

An assessment regarding the vertical extent of contamination was based upon review of the sampling results and soil descriptions from Area 3 Removal Action. Reportedly, the Removal Action showed that the soil contamination was primarily confined to a subsurface zone of eluviated organic silty sand varying in thickness from 2-inches to 1-foot. This layer varied in depth from three to five feet in the northern source area to 1-foot at the far southern extent of the excavation. However, it is also noted that there was a PRG exceedance at 4 feet bgs at removal action sample EX57W11X (prior to additional excavation) located at the south end of the excavation. Groundwater is reported to be at approximately 222 to 223 feet MSL in this area, only 1-1/2 to 3 feet bgs. Based upon the Removal Action findings, it is assumed for cost estimating purposes that the average depth of the residual contaminated soil would extend down to approximately 3 feet bgs. The estimated in-place volume of soils containing EPH C11-C22 aromatic carbon range concentrations in excess of its PRGs is 120 cy.

3.5.4.2 Area 3 – Upland Groundwater. Area 3 upland groundwater contains arsenic, cadmium and 1,4-DCB in concentrations in excess of PRGs (50 μg/L for arsenic, 5 μg/L for cadmium, and 5 μg/L for 1,4-DCB) for the Unrestricted Use scenario. A review of existing groundwater analytical data shows that PRGs were exceeded for cadmium and 1,4-DCB at 57M-95-03X (8.67 μg/L for cadmium and 5.6 μg/L for 1,4-DCB in the October 1996 sampling round). There were no exceedances of these compounds in the downgradient Area 3 Wetland Area during any groundwater sampling round. Arsenic was detected in 57M-95-03X at a concentration of 74 μg/L, exceeding its MCL/MMCL in the earliest sampling round (November 1995) but not in subsequent rounds. 57M-95-03X is screened at the water table with a 10-foot screen. These PRG exceedances are shown in Figure 3-6.

3.5.4.3 Area 3 – Wetland Groundwater. Area 3 wetland groundwater contains arsenic and PCE in concentrations in excess of PRGs (50 μg/L for arsenic and 5 μg/L for PCE) for the Unrestricted Use scenario. A review of existing groundwater analytical data shows

that PRGs were exceeded for arsenic and PCE at 57M-96-11X (170 μg/L and 84.4 μg/L for arsenic in the October 1996 and May 1998 sampling rounds, respectively, and 5.4 μg/L for PCE in the May 1998 sampling round). 57M-96-11X is screened proximate to the water table with a 10-foot screen. These PRG exceedances are shown in Figure 3-6.

3.6 GENERAL RESPONSE ACTIONS

General response actions are categories of remedial actions that may be used to satisfy RAOs by either reducing the contaminant concentration in each medium below the PRG or by preventing receptor exposure to the contaminated medium. General response actions describe categories of remedial actions that may be employed to satisfy RAOs and provide the basis for identifying specific remedial technologies.

Potential general response actions to meet soil RAOs include:

- No Action
- Limited Action
- Containment
- Removal
- On-Site Treatment
- Disposal

Potential general response actions to meet groundwater RAOs include:

- No Action
- Limited Action
- Collection/Treatment
- Discharge

4.0 TECHNOLOGY SCREENING AND ALTERNATIVE DEVELOPMENT

This section identifies and screens remedial technologies to attain the RAOs established in Subsection 3.4. Upon selection of candidate technologies based upon site- and waste-limiting characteristics, a range of remedial alternatives for Areas 2 and 3 are assembled for further screening and detailed evaluation. This process is in general conformance with the USEPA RI/FS guidance (USEPA, 1988).

Conventional FS processes entail identifying and screening multiple technologies and development of a wide range of alternatives for further screening. However, this report focuses on a more limited set of potential technologies narrowed by site-specific conditions, past successful remedial action efforts, and potential future uses of the site. Technology identification and alternative development are based upon achieving the RAOs for the two exposure scenarios, the possible future use scenario and the more stringent unrestricted land use scenario. Preparation of an FFS streamlines the evaluation process and was agreed upon between the Army and the regulatory agencies considering the remaining extent and location of residual contamination following the several removal actions that have already been performed at the site.

4.1 TECHNOLOGY IDENTIFICATION AND SCREENING

Tables 4-1 and 4-2 identify and screen a number of soil and groundwater technologies based on probable effectiveness and implementability with regard to site- and waste-limiting characteristics. Site limiting characteristics consider the effect of site-specific physical features, such as proximity of wetland areas, topography, buildings, underground utilities, and available space. Waste-limiting characteristics consider the suitability of a technology based on contaminant types, individual compound properties, and complications with mixtures of compounds.

As summarized in Table 4-1, retained soil technologies include the Limited Action Response Action technologies of deed restrictions, zone restrictions, and fencing. These technologies were retained as potential components for assembled remedial alternatives because of their ability to minimize potential exposure to contaminated soils by physically restricting access. Excavation and disposal were also retained based on consideration of past successful implementation of removal actions at both Areas 2 and 3. Technologies pertaining to on-site treatment were eliminated in part due the presence of mixed organic and inorganic wastes which, in most instances, require more than one technology for effective treatment. On-site treatment technologies that leave residual treated material (i.e., asphalt batching, stabilization/solidification) also impact future land use depending upon final disposal location. If the soils are to be excavated, it was the Army's preference to remove these soils from the site.

As summarized in Table 4-2, retained groundwater technologies include technologies pertaining to Limited Action. These include, zoning restrictions, deed restrictions, groundwater monitoring, and surface water monitoring. Active treatment using ex-situ treatment technologies such as air stripping, activated carbon and metals removal, or in-situ treatment (for organic contaminant removal only) were eliminated principally due to the fact that under current land use there is no use or exposure to groundwater at AOC 57. AOC 57 is not within the Zone II of a potentially productive aquifer. Because Devens has a municipal water supply, commercial/industrial properties that are constructed at AOC 57 under future land use scenarios would be supplied with municipal water. Therefore, risk evaluation of exposures to potable water, which is driving the need for a groundwater response action, represents only a theoretical scenario.

4.2 DEVELOPMENT OF ALTERNATIVES

In this subsection, the technologies retained following the screening described in Subsection 4.1 are combined to form remedial action alternatives. Alternatives were developed for each of the areas at AOC 57 to attain the RAOs discussed in Subsection 3.4. Tables 4-3, 4-4, and 4-5 summarize the assembled alternatives for Area 2-Wetland, Area 3-Wetland, and Area 3-Upland, respectively. These tables also present how each of the components of these alternatives will achieve the RAOs. The following subsections describe the alternatives for each area at AOC 57 providing enough detail to proceed with alternative screening with respect to effectiveness, implementability and cost in Section 5.0. Alternative components are described in greater detail for FFS costing purposes for each retained alternative in Section 6.0, Detailed Analysis of Alternatives.

4.2.1 Development of Area 2 Wetland Alternatives

The alternatives identified for the Area 2 wetland at AOC 57 include the following:

Alternative II-1: No Action
Alternative II-2: Limited Action
Alternative II-3: Excavation (For Possible Future Use) And Institutional Controls
Alternative II-4: Excavation (For Unrestricted Use) And Institutional Controls

The following subsections describe the four alternatives developed for the Area 2 wetland.

4.2.1.1 Alternative II-1: No Action. The No Action Alternative does not include any remedial action components to reduce or control potential human-health risks at Area 2. The No Action Alternative will not be evaluated according to screening criteria; it will pass through screening to be evaluated during the detailed analysis as a baseline for comparison with other retained alternatives (USEPA, 1988).

4.2.1.2 Alternative II-2: Limited Action. The Limited Action Alternative consists of implementing institutional controls and environmental sampling at the Area 2 wetland. Institutional controls in the form of land-use restrictions would limit construction activities and prohibit residential use) of the wetland portion of Area 2.

For protection from possible future-use soil exposures (construction worker scenario), deed restrictions would be imposed on the site to restrict invasive activities within the contaminated soil area where there are exceedances of possible future-use PRGs (Figure 3-1). As part of the deed restriction, the contaminated soil area would be surveyed and identified with permanent survey markers. Contractors performing work within this area would be required to follow precautionary measures to minimize risk to human health and the environment. Land-use restrictions in the form of zoning or deed restrictions would also be imposed in the wetland area to prohibit residential contact with contaminated soil and residential well installation for potable use (for protection from unrestricted-use soil and groundwater exposures). Also, deeds for the adjacent upland area at Area 2 would contain advisories recommending that the potential zone of influence of any proposed upland potable wells be assessed with respect to the downgradient wetland groundwater contamination.

Environmental sampling would consist of performing long-term groundwater and surface water sampling. Long-term groundwater sampling would be a component of the Limited Action Alternative to assess whether the groundwater COCs, arsenic and PCE, decrease to concentrations that are protective of residential receptors. Based on 1996 groundwater data, only monitoring well 57M-95-04A contains PCE concentrations (16 μg/L) in excess of its PRG (5 μg/L). PCE was also detected at concentrations below its PRG in Rounds 1 and 2 at 57M-95-07X (4.0 and 3.9 μg/L, respectively). Similarly, arsenic was found to exceed its PRG (50 μg/L) in only one sampling location, 57P-98-02X, at a concentration of 54.4 μg/L. It is anticipated that because of the removal of approximately 1,300 cy of contaminated soil in 1994, groundwater conditions will continue to improve at the site. Surface water sampling would also be a component of environmental sampling to assess for migration of human-health COCs off-site via the groundwater to surface water pathway. Based on the RI, groundwater in the overburden at Area 2 discharges to Lower Cold Spring Brook and its associated wetlands. However, as determined by the baseline ecological risk assessment, there are no significant risks associated with Area 2 contaminants to ecological receptors based upon surface soil, sediment, and surface water sampling. Furthermore, there does not appear to be a risk to aquatic receptors for the chemicals common to groundwater and surface water. Therefore, the purpose of the surface water sampling would not be to collect additional ecological risk assessment data but rather to provide additional means to confirm that the human-health COCs that exceed PRGs are not migrating off-site via Lower Cold Spring Brook.

Sampling frequency, location, analytes, sampling procedures, and action levels for

environmental monitoring would be detailed in a long-term monitoring plan and submitted to regulatory agencies for review prior to implementing the environmental monitoring component of this alternative.

Contamination above concentrations considered protective of human health for unrestricted-use scenarios would remain on site with this alternative. Therefore, five-year site review would be conducted to evaluate environmental sampling results and to ensure that the alternative remains protective of human health and the environment.

4.2.1.3 Alternative II-3: Excavation (For Possible Future Use) And Institutional Controls. This alternative would rely on excavation of contaminated soils from Area 2 wetlands to protect possible future-use receptors (recreational users and construction workers); and institutional controls to protect residential receptors. Area and depth of the excavation would include soils with Aroclor-1260 and lead concentrations in excess of PRGs that are considered protective of possible future use (recreational/construction). As part of the design for the soil removal activities in Alternative II-3, predesign confirmation soil sampling would be performed within the 1994 Area 2 Soil Removal Area to demonstrate that the soil within the former excavation does not contain Aroclor-1260 and lead concentrations above PRGs. Pre-design sampling would focus at areas where elevated contaminant levels were reported upon the conclusion of the 1994 Removal Action. Details of the proposed sampling would be included as part of the remedial design for review by the regulatory agencies. The total in-place volume of soil to be excavated at Area 2 is estimated to be approximately 640 cy. Excavation of soil would be completed using conventional construction equipment such as backhoes, front-end loaders, and dump trucks.

Wetland redelineation, protection, restoration, and monitoring would also be performed as a result of potential wetland impacts from excavation activities. Construction work would be within the 100-year flood plain (228 feet msl) and would likely be within the delineated bordering vegetated wetland based on 1993 wetlands delineation as depicted in Figure 3-3. As a precursor to remedial activities, the wetlands at Area 2 would be redelineated. If the proposed construction area is confirmed to be within delineated vegetated wetlands, a pre-construction mitigation study would be performed to determine the impact to the affected area and the compensatory mitigation required as a result of the excavation activities. Once the extent of anticipated impacts is known, a mitigation plan would be prepared for agency review and approval. During construction, erosion control measures such as silt fencing and hay bales would be used to protect against erosion and siltation within the floodplain area. Final backfilled excavation grades would be required to match existing grade. Compensatory mitigation and monitoring would be implemented according to the approved mitigation plan. A wetland scientist would monitor wetlands restoration for a period of five years, beginning the year after the wetlands creation.

Land-use restrictions in the form of administrative controls and deed restrictions would

be implemented to prohibit residential use of the wetland portion of Area 2. Land use restrictions would minimize residential contact with contaminated soil in addition to prohibiting well installation for residential use in the wetland area. Also, deeds for the adjacent upland area at Area 2 would contain advisories recommending that the potential zone of influence of any proposed upland potable wells be assessed with respect to the downgradient wetland groundwater contamination.

As with Alternative II-2 (see Subsection 4.2.1.2), environmental monitoring and five-year site reviews would be conducted to ensure that the alternative remains protective of human health and the environment.

4.2.1.4 Alternative II-4: Excavation (For Unrestricted Use) And Institutional Controls. This alternative would rely on excavation of contaminated soils from Area 2 wetlands to protect residential receptors from contacting contaminated soils; and institutional controls to protect residential receptors from ingesting contaminated groundwater. Area and depth of the excavation would include soils with Aroclor-1260, arsenic, chromium, lead, and the EPH C11-C22 aromatic carbon range concentrations in excess of PRGs that are considered protective for unrestricted (residential) use. As with Alternative II-3, predesign confirmation soil sampling would also be performed within the 1994 Area 2 Soil Removal Area to demonstrate that the soil within the former excavation does not contain COC exceedances above PRGs. Sampling would be performed for Aroclor-1260, arsenic, chromium, lead, and EPH C11-C22 and would focus at areas where elevated contaminant levels were reported upon the conclusion of the 1994 Removal Action. As with Alternative II-3, details of the proposed confirmation sampling program within the former excavation would be included as part of the remedial design for review by the regulatory agencies. The total in-place volume of soil to be excavated would be greater than for Alternative II-3 and is estimated to be approximately 1,800 cy. Construction, and wetland redelineation, protection, restoration, and monitoring would be performed as described in Alternative II-3 (see Subsection 4.2.1.3).

Land-use restrictions in the form of administrative controls and deed restrictions would be implemented to prohibit well installation within the Area 2 wetland aquifer for residential use and to implement advisories for potable well installations in the adjacent upland Area 2 as discussed in Alternative II-2.

As with Alternative II-2 (see Subsection 4.2.1.2), environmental monitoring and five-year site reviews would be conducted to ensure that the alternative remains protective of human health and the environment.

4.2.2 Development of Area 3 Upland/Wetland Alternatives

The alternatives identified for the Area 3 upland/wetland at AOC 57 include the following:

Alternative III-1: No Action
Alternative III-2: Limited Action
Alternative III-3: Excavation (For Unrestricted Use) And Institutional Controls

The following subsections describe the three alternatives developed for Area 3.

4.2.2.1 Alternative III-1: No Action. The No Action Alternative does not include any remedial action components to reduce or control potential human-health risks at Area 3. The No Action Alternative will not be evaluated according to screening criteria; it will pass through screening to be evaluated during the detailed analysis as a baseline for comparison with other retained alternatives (USEPA, 1988).

4.2.2.2 Alternative III-2: Limited Action. The Limited Action Alternative consists of implementing institutional controls and environmental sampling at the Area 3 upland and wetland. Institutional controls in the form of land-use restrictions would prohibit well installation in the Area 3 upland for commercial/industrial and residential use. Land-use restrictions would also prohibit residential development of the wetland portion of Area 3 thereby limiting contact with contaminated soil and prohibiting well installation for residential or commercial use. Because risks to the construction worker from soil exposure are within USEPA's CERCLA risk range, deed restrictions to limit construction activity within wetland soil, as used in a component for Alternative II-2, would not be required for Alternative III-2.

Environmental sampling would consist of long-term groundwater and surface water sampling. Long-term groundwater sampling would be performed to assess for the eventual decrease in arsenic, PCE, cadmium, and 1,4-DCB concentrations (upland and wetland COCs), and for the need for continued groundwater institutional controls for protectiveness of human receptors. In wetland groundwater, only monitoring well 57M-96-11X contained PCE and arsenic concentrations (maximum of 5.4 μg/L and 170 μg/L, respectively) that exceeded PRGs based on 1996 and 1998 sampling rounds. In upland groundwater, PRGs for cadmium and 1,4-DCB were exceeded at 57M-95-03X (8.67 μg/L and 5.6 μg/L, respectively) in October 1996 and arsenic (74 μg/L) in November 1995. It is anticipated that because of the removal of approximately 1,860 cy of contaminated soil from Area 3 in the spring of 1999, groundwater conditions will continue to improve at the site. Surface water sampling would also be a component of environmental sampling to assess for migration of human-health COCs off-site via the groundwater to surface water pathway. Based on the RI, groundwater in the overburden at Area 3 discharges to Lower Cold Spring Brook and its associated wetlands. However, as discussed for Area 2, there are no significant risks associated with AOC 57 contaminants to ecological receptors as determined by the baseline ecological risk assessment. Therefore, the purpose of the surface water sampling would not be to collect additional ecological risk assessment data but rather to provide additional means to assess that human-health COCs are not migrating off-site via Lower Cold Spring Brook. Sampling frequency, location, analytes, sampling procedures,

and action levels for environmental monitoring would be detailed in a long-term monitoring plan and submitted to the regulatory agencies for review prior to implementing the environmental monitoring component of this alternative.

Contamination above concentrations considered protective of human-health for unrestricted scenario would remain on site with this alternative. Therefore, five-year site review would be conducted to evaluate environmental sampling results and to ensure that the alternative remains protective of human health and the environment.

4.2.2.3 Alternative III-3: Excavation (For Unrestricted Use) And Institutional Controls. This alternative would rely on excavation of contaminated soils from Area 3 wetlands to protect residential receptors from contacting contaminated soils; and institutional controls to protect residential and commercial/industrial receptors from ingesting contaminated groundwater in the upland and wetland areas.

Area and depth of the excavation would include soils with EPH C11-C22 aromatic carbon range concentrations in excess of its PRG that is considered protective of human health for the unrestricted use scenario. The in-place volume of soil to be excavated is estimated to be approximately 120 cy. Excavation of soil would be completed using conventional construction equipment such as backhoes, front-end loaders, and dump trucks. Construction would be within the 100-year flood plain (228 feet msl) and likely be within the delineated bordering vegetated wetland. Final backfilled excavation grades would be required to match existing grade. Wetland redelineation, protection, restoration, and monitoring would also be performed as described in Alternative II-2 (see Subsection 4.2.1.2).

Land-use restrictions in the form of administrative controls and deed restrictions would be implemented to prohibit well installation in upland and wetland areas.

As with Alternative III-2 (see Subsection 4.2.1.2), environmental monitoring and five-year site reviews would be conducted to ensure that the alternative remains protective of human health and the environment.

5.0 SCREENING OF ALTERNATIVES

The objective of alternative screening is to eliminate impractical alternatives or alternatives that have significantly higher costs (i.e., order of magnitude cost differences), or that provide little or no increase in effectiveness or implementability over their lower-cost counterparts. Alternatives are screened with respect to the criteria of effectiveness, implementability, and cost consistent with requirements of CERCLA and the NCP. Each criterion is described briefly in the following paragraphs.

Effectiveness. Each alternative is evaluated for its ability to protect human health and the environment, including the extent to which toxicity, mobility, or volume of contaminants is reduced. Both short- and long-term effectiveness are considered. Short-term effectiveness involves the extent to which existing risks to receptors during the construction and implementation period are reduced, identifying and mitigating expected effects to the environment during construction and implementation, the alternative's ability to meet RAOs, and the relative time frame required to achieve RAOs. Long-term effectiveness, which applies after RAOs have been attained, considers the magnitude of the remaining residual risk due to residual contaminant sources, and the adequacy and reliability of specific technical components and control measures to maintain compliance with RAOs over the life of the remediation.

Implementability. Each alternative is evaluated in terms of technical and administrative feasibility. In the assessment of short-term technical feasibility, availability of a technology for construction or mobilization and operation, as well as compliance with action-specific ARARs during the remedial action, are considered. Long-term technical feasibility considers the ease of O&M, the ease of undertaking additional remedial actions, and the ease of replacement and monitoring. Administrative feasibility for implementing a given technology addresses coordination with other agencies, public acceptance, and the commercial availability of required services and trained specialists or operators.

Cost. The final criterion for initial screening of alternatives is the cost associated with the given remedy. USEPA guidance indicates that the focus of cost estimates during screening should be to make comparative estimates for alternatives with relative accuracy so that cost decisions among alternatives will be sustained as the accuracy of cost estimates improves beyond screening (USEPA, 1988). Relative capital and O&M costs are discussed at this stage, as well as factors influencing cost sensitivity. Potential liability associated with untreated waste and treatment residuals also is discussed.

For each alternative, a matrix was developed highlighting the alternative's advantages and disadvantages with respect to effectiveness, implementability, and cost. The screening matrix presents a clear, concise procedure for screening potential remedial action alternatives. Based on this matrix, a decision is made to either retain the alternative for detailed analysis or eliminate it from further consideration. Tables 5-1 through 5-6

present the screening matrices for each alternative.

The No Action Alternative for each area is not evaluated according to the screening criteria; it will pass through screening to be evaluated during the detailed analysis as a baseline for other retained alternatives (USEPA, 1988).

5.1 SCREENING OF AREA 2 ALTERNATIVES

Tables 5-1 through 5-3 present the screening matrices for the alternatives developed for wetland area soil and groundwater at Area 2 of AOC 57. Based on the criteria of effectiveness, implementability and cost, the three alternatives for the Area 2 wetland were all retained for detailed analysis. These alternatives provide a range remedial actions by varying the degree of institutional controls implemented with respect to the quantity of soil excavated. All alternatives will effectively minimize the risk to commercial/industrial and residential receptors either through soil removal and/or implementation of deed restrictions.

5.2 SCREENING OF AREA 3 ALTERNATIVES

Tables 5-4 and 5-5 present the screening matrices for the alternatives developed for upland and wetland areas at Area 3 of AOC 57. Based on the criteria of effectiveness, implementability and cost, the two alternatives for Area 3 were also retained for detailed analysis. As with the Area 2 alternatives, the alternatives for Area 3 provide a range remedial actions by varying the degree of institutional controls implemented with respect to the quantity of soil excavated. Both alternatives will effectively minimize the risk to commercial/industrial and residential receptors either through soil removal and/or implementation of deed restrictions.

6.0 DETAILED ANALYSIS OF ALTERNATIVES

This section presents the detailed analyses of remedial action alternatives for soil and groundwater at AOC 57. The detailed analysis is intended to provide decision-makers with information to aid in selection of a remedial alternative for each medium of concern that best meets the following CERCLA requirements:

- protects human health and the environment
- attains ARARs (or provides grounds for invoking a waiver)
- is cost-effective
- provides a permanent solution using alternative treatment technologies or resource-recovery technologies to the maximum extent practicable
- satisfies the preference for treatment that reduces toxicity, mobility, or volume of hazardous substances as a principal element

The detailed analysis was conducted in accordance with CERCLA Section 121, the NCP (USEPA, 1990 and 1993a), and USEPA RI/FS guidance (USEPA, 1988). The detailed analysis contains the following for Areas 2 and 3:

- a detailed description of each candidate remedial alternative emphasizing the application of various component technologies
- an evaluation of each alternative against the first seven of the nine evaluation criteria described in the NCP (see Table 1-1) (USEPA, 1990 and 1993a)

The detailed description of technologies or processes used for each alternative includes where appropriate, preliminary site layouts, and a discussion of limitations, assumptions, and uncertainties for each component. These descriptions are intended to provide a conceptual design of each alternative, and are intended to be used for alternative-comparison and cost-estimation purposes only.

Remedial alternatives for each medium of concern are evaluated according to the first seven of nine NCP evaluation criteria. The nine NCP evaluation criteria are defined in the following paragraphs as they pertain to this FFS.

Overall Protection of Human Health and the Environment. This criterion addresses an alternative's ability to provide adequate protection and describes how human-health risks posed by soil and groundwater contamination are eliminated, reduced or controlled through treatment, engineering controls, or institutional controls.

Compliance with ARARs. This criterion addresses whether or not an alternative will meet chemical-, location-, and action-specific ARARs of federal and state environmental statutes and other requirements or will provide grounds for invoking a waiver.

Long-term Effectiveness and Permanence. This criterion refers to an alternative's ability to maintain reliable protection of human health and the environment over time, once clean-up goals have been met.

Reduction of Toxicity, Mobility, or Volume through Treatment. This criterion addresses the anticipated performance of the treatment technologies an alternative employs, if applicable. It also evaluates the degree of expected reduction and the degree to which the treatment is irreversible.

Short-term Effectiveness. This criterion addresses the period of time needed to achieve remediation goals and the adverse impacts on human health and the environment that may be posed during the construction and implementation of the alternative.

Implementability. This criterion pertains to the technical and administrative feasibility of an alternative, including the availability of materials and services needed to implement a particular remedy. It discusses the alternative's reliability and ease of implementation as well as the regulatory acceptance of the alternative.

Cost. This criterion should include an estimate of the capital and operation and maintenance (O&M) costs and net present worth (NPW) costs.

State Acceptance. This criterion indicates whether the MADEP concurs, opposes, or has no comment on the selected alternative.

Community Acceptance. This criterion is an assessment of the public comments received on the proposed remedy as presented in the Proposed Plan.

State acceptance and community acceptance will be addressed in the ROD following receipt of comments on the Final FFS and Proposed Plan, respectively.

The detailed analysis for each alternative for each area includes an estimate of the time necessary for completion of the alternative (i.e., remedial duration) and a detailed cost estimate. The time-frame estimates were based on published construction scheduling material, and professional judgment. Costs are intended to be within the target accuracy range of minus 30 to plus 50 percent of actual cost (USEPA, 1988). Because there is uncertainty associated with the in-place material volumes that may be treated or removed and disposed of, the treatment times, and the future cost of vendor services, costs should be viewed as estimates only. Assumptions may or may not remain valid during alternative implementation. For example, details associated with long-term monitoring,

such as the number and location of monitoring wells and surface water sampling points, have not been agreed upon, and will be determined in the Long-term Monitoring Plan (LTMP) to be completed as part of the alternative implementation. Similarly, confirmation sampling frequency and methodology will be determined in the design. This FFS provides assumptions regarding the scope of the LTMP and design for purposes of detailed analysis and cost estimation. In addition, the cost of each alternative is estimated based on the assumption that it is implemented as a stand-alone action for each area. It is possible that a common remedial action alternative (e.g., excavation of soil in Area 2 and 3) could be implemented simultaneously, resulting in a lower total cost. These and other cost uncertainties are discussed in the individual cost subsections.

Each cost estimate includes a present worth analysis to evaluate expenditures that occur over different periods. The analysis discounts future costs to a present worth and allows the cost of remedial alternatives to be compared on an equal basis. Present worth represents the amount of money that, if invested now and disbursed as needed, would be sufficient to cover costs associated with the remedial action over its planned life (USEPA, 1988). Consistent with USEPA guidance, a discount rate of 7 percent before taxes and after inflation was used to prepare the cost estimates (USEPA, 1993b).

Each cost estimate includes the following items:

- a contingency to account for unforeseen project complexities such as adverse weather, the need for additional site characterization, and increased construction standby times at a percentage of direct capital costs

- engineering design and construction services at a percentage of direct capital costs

- health and safety, legal, and administrative fees at a percentage of direct capital costs

Costs are presented as a NPW value for the lifetime of the remedial alternative based on the estimated clean-up time. For alternatives with an indefinite clean-up period, or if anticipated to require greater than 30 years, a 30-year NPW cost is presented. Present worth for a 30-year period is provided as recommended by CERCLA guidance (USEPA, 1988) because of the uncertainty in assumptions such as discount rate, inflation, and technology advancement for periods greater than 30 years. Cost summary tables are presented for each alternative and identify capital, O&M, and NPW costs. Details, further assumptions and a cost sensitivity analysis are included in each alternative's cost description.

Alternatives retained from Section 5.0 for detailed analysis include:

Area 2 Wetland

- Alternative II-1: No Action
- Alternative II-2: Limited Action
- Alternative II-3: Excavation (for Possible Future Use) and Institutional Controls
- Alternative II-4: Excavation (for Unrestricted Use) and Institutional Controls

Area 3 Upland/Wetland

- Alternative III-1: No Action
- Alternative III-2: Limited Action
- Alternative III-3: Excavation (for Unrestricted Use) and Institutional Controls

The No Action alternatives were retained for each area as a baseline with which to compare other alternatives.

Tables 6-1 through 6-21 present the chemical-, action- and location-specific ARARs for each of the alternatives evaluated. Tables 6-22 through 6-26 present a summary of the costs for each alternative. Detailed cost spreadsheets for NPW costs and non-discounted costs are contained in Appendix B.

6.1 Detailed Analysis of Area 2 Wetland Alternatives

This subsection provides a detailed description for each alternative retained for Area 2 Wetland, includes a cost estimate, and evaluates the alternative using the seven evaluation criteria.

6.1.1 Alternative II-1: No Action

Alternative II-1, the No Action Alternative was retained as a baseline with which to compare the other alternatives, as required by the NCP. Remedial action, monitoring, further investigations, and site reviews would not be conducted as part of this alternative. The following assessment of the No Action Alternative is based on the first seven evaluation criteria presented in Table 1-1.

6.1.1.1 Overall Protection of Human Health and the Environment. The human-health risk assessment identified risks in excess of USEPA's Superfund risk range and target HI from exposure to surface and subsurface soils and groundwater only for possible future land use and unrestricted land use scenarios, and not for current land use. Aroclor-1260, lead, arsenic, chromium, and EPH C11-C22 aromatic carbon range concentrations exceed risk-based PRGs in soils. Arsenic and PCE exceed ARAR-based PRGs in groundwater. The ecological risk assessment did not identify unacceptable risks to ecological receptors from exposure to sediments or surface water. Therefore, the No Action Alternative will not provide protection to human health but will be protective of the environment.

6.1.1.2 Compliance with ARARs. ARARs triggered by Alternative II-1 are presented in Table 6-1. The No Action Alternative would not include any actions to reduce contaminant concentrations in site soils or groundwater. Although the soil contaminants would remain on site, soil PRGs were not established using promulgated guidance values and therefore are not considered ARARs.

Groundwater COCs that exceed chemical-specific ARARs (e.g., MCLs and MMCLs) are arsenic and PCE. Chemical-specific ARARs would not be met by this alternative in the short-term, but may be met by natural attenuation processes in the long-term. Emphasis is placed here on the few marginal exceedances of MCLs/MMCLs in the wetland groundwater. Based on 1996 groundwater data, only monitoring well 57M-95-04A contains PCE concentrations (16 μg/L) in excess of its MCL/MMCL (5 μg/L). Similarly, arsenic was found to exceed its MCL/MMCL (50 μg/L) in only one sampling location, 57P-98-02X, at a concentration of 54.4 μg/L. This suggests that there is not a significant area (or volume) of groundwater exceeding MCLs/MMCLs.

Although there were sporadic detections of arsenic in surface soils at AOC 57 above its background concentration, no apparent disposal areas or source areas of arsenic were identified during the RI. The elevated concentrations of arsenic (the only major risk contributor at both Area 2 and 3) observed in the groundwater are believed to be primarily naturally present. That is to say, past AOC 57 activities may have effected the solubility of naturally occurring arsenic in the groundwater as has been observed at numerous sites at Devens, including Shepley's Hill Landfill and AOC 43J. The higher dissolved concentrations of arsenic are likely because of reducing conditions created by ongoing biological degradation of site-related organic contaminants. Studies show that hydrocarbon biodegradation is essentially an oxidation-reduction reaction where the hydrocarbon is oxidized (donates electrons) and an electron acceptor, such as oxygen, is reduced (accepts electrons) (Borden, 1995; McAllister, 1994). Although arsenic is not directly identified as an electron acceptor in microbial induced processes, its increased solubility is likely because of the changed chemical environment. For instance, arsenic is more soluble at low ORP (As[III] is more soluble than As[V]). The soil removal action performed in 1994 at Area 2 has significantly reduced petroleum contamination in soil, thereby mitigating the probable leaching of naturally occurring arsenic.

RI soil sampling results at the perimeter of the former removal action excavation reveal only sporadic and trace concentrations of residual PCE in soil. The maximum detected concentration, 0.0059 mg/kg 57E-95-07X, is well below the MCP S-1/GW-1 standard of 0.5 mg/kg that is considered protective of groundwater. It is therefore assumed that the majority of any residual PCE source that would act as a continuing source to groundwater contamination was removed in the 1994 soil removal action. Groundwater conditions are expected to continue to improve at the site through natural diffusion and dispersion processes and ARARs are anticipated to be eventually achieved. However, monitoring would not be performed to measure changes in the contaminant concentrations, or

migration; therefore attainment of ARARs would not be established. Because no action is proposed, location- and action-specific ARARs would not be triggered by this alternative.

6.1.1.3 Long-term Effectiveness and Permanence. This alternative does not provide controls to reduce concentrations of COCs in soil to PRGs. Therefore, the No Action Alternative will not provide long-term effectiveness and permanence for protecting human health from exposure to soil at AOC 57 Area 2.

This alternative also does not provide controls to reduce concentrations of COCs in groundwater to PRGs. However, as discussed in Subsection 6.1.1.2, Compliance with ARARs, groundwater conditions are expected to continue to improve at the site and PRGs will eventually be achieved through diffusion and dispersion processes (and by volatilization and biodegradation processes for PCE). However, the effectiveness of these processes would not be monitored, and therefore are not considered during evaluation of this alternative.

6.1.1.4 Reduction of Toxicity, Mobility, or Volume Through Treatment. The No Action Alternative does not employ active removal or treatment processes to address soil or groundwater contamination; therefore, the alternative would not satisfy CERCLA's statutory preference for treatment as a principal component of remedial action.

6.1.1.5 Short-term Effectiveness. This alternative does not provide any remedial actions; therefore, short-term risks to the community or environment would not result from implementation. Soil exposure would not be restricted under this alternative and as a result, the alternative would not provide short-term protection to human receptors, should a construction worker be permitted to work or if residential development were permitted in the Area 2 wetland. Groundwater exposure would not be restricted or minimized. Therefore this alternative would not provide short-term protection to residential receptors should potable water wells be installed in the Area 2 aquifer for residential use.

6.1.1.6 Implementability. Because this alternative does not propose remedial action, there would be no technical or administrative difficulties associated with implementation. Additionally, the No Action Alternative would not limit or interfere with the ability to perform future remedial actions.

6.1.1.7 Cost. There is no cost associated with the No Action Alternative because no remedial actions are performed.

6.1.2 Alternative II-2: Limited Action

Alternative II-2, Limited Action, is designed to reduce potential human-health risks associated with contaminated soil and groundwater at the Area 2 wetland. This

alternative would consist of implementing institutional controls to protect possible future-use (construction worker) receptors and unrestricted-use (residential) receptors. Environmental monitoring would be performed at the site to assess for groundwater COC migration. Five-year site reviews would be performed to ensure that the remedial alternative remains protective of human health and the environment. Alternative II-2 would consist of the following specific components:

- Institutional Controls
  - Land-use restrictions that control excavation activities at the Area 2 wetland
  - Land-use restrictions that prohibit residential use of wetland property and potable use of the aquifer
- Environmental Monitoring
  - Long-term groundwater monitoring
  - Long-term surface water monitoring
- Institutional Control Inspections
- Five-year Site Reviews

Institutional Controls. Institutional controls in the form of land-use restrictions would limit construction activities and prohibit residential use of the wetland portion of Area 2. Institutional controls are proposed in the form of zoning and deed restrictions for any property released by the U.S. Army as part of base closure activities. AOC 57 is located within an area designated for "Rail, Industrial, Trade-Related, and Open Recreational" in the Devens Reuse Plan (Vanasse Hangen Brustlin, 1994).

For protection from possible future-use soil exposures (construction worker scenario), deed restrictions would be imposed on the site to restrict invasive activities within the contaminated soil area where there are exceedances of possible future-use PRGs (Figure 3-1). As part of the deed restriction, the contaminated soil area would be surveyed, staked-out with permanent survey markers, and identified as an Excavated Soils Management Area (ESMA). Contractors performing work within the ESMA would be required to prepare and follow an Excavated Soils Management Plan that would define the precautionary measures to be taken to minimize risk to human health and the environment.

Land-use restrictions in the form of zoning or deed restrictions would also be imposed to prohibit residential contact with contaminated soil and well installation in the wetland area for potable use (for protection from unrestricted-use soil and groundwater exposures). Also, deeds for the adjacent upland area at Area 2 would contain advisories recommending that the potential zone of influence of any proposed upland potable wells be assessed with respect to the downgradient wetland groundwater contamination. All the land-use restrictions would be stated in full or by reference within zoning ordinances and/or deeds, easements, mortgages, leases or other instrument of property transfer and would be maintained indefinitely. These controls would be drafted, implemented and enforced in cooperation with state and local government.

Environmental Monitoring. Environmental monitoring would consist of performing long-term groundwater and surface water sampling. Long-term groundwater sampling would be performed to assess for groundwater COC (arsenic and PCE) migration and to observe for the eventual decrease of the groundwater COCs to concentrations that are protective of residential receptors. As discussed in Subsection 6.1.1.2, Compliance with ARARs for Alternative II-1, it is anticipated that because of the removal of approximately 1,300 cy of contaminated soil in 1994, groundwater conditions will continue to improve at the site and groundwater PRGs will be eventually achieved.

Surface water sampling would also be a component of environmental sampling to assess for migration of human-health COCs off-site via the groundwater to surface water pathway. Based on the RI, groundwater in the overburden at Area 2 discharges to Lower Cold Spring Brook and its associated wetlands. However, as determined by the baseline ecological risk assessment, there are no significant risks associated with Area 2 contaminants to ecological receptors based upon surface soil, sediment and surface water sampling. Furthermore, there does not appear to be a risk to aquatic receptors for the chemicals common to groundwater and surface water. Therefore, the purpose of the surface water sampling would not be to collect additional ecological risk assessment data but rather to provide additional means to confirm that the human-health COCs that exceed PRGs are not migrating off-site via Lower Cold Spring Brook.

Sampling frequency, location, analytes, sampling procedures, and action levels for environmental monitoring would be detailed in a site LTMP and submitted to the regulatory agencies for review prior to implementing the environmental monitoring component of this alternative. For FFS cost estimating purposes, it is assumed that groundwater and surface water sampling would be performed twice per year for the first three years and once per year thereafter. It is also assumed that environmental sampling would be terminated upon obtaining groundwater PRG concentrations for three consecutive sampling events. Costing was based on the assumption that samples would be collected from four existing down-gradient or cross-gradient monitoring wells/piezometers and one existing upgradient monitoring well using low-flow sampling techniques. Surface water samples would be collected from three locations where groundwater discharges from Area 2 and one upgradient location within Lower Cold Spring Brook. Samples would be analyzed for arsenic and PCE. Both filtered and unfiltered samples would be collected for arsenic.

Institutional Control Inspections. Regularly scheduled inspections would be performed to confirm that land-use restrictions in the form of deed or zoning restrictions are implemented as required to minimize potential human exposure to soil and groundwater contaminants left at the site.

An Institutional Control Monitoring Plan would be prepared and submitted for regulatory agency review as part of the site LTMP to detail the land-use restrictions to be incorporated/referenced in zoning ordinances or within instruments of property transfer.

The plan would include a checklist of elements to be assessed during regularly scheduled on-site inspections and interviews with the site property owner, manager or designee. For FFS purposes, it is assumed that elements of the on-site inspection would include verifying that no wells for potable use have been installed on the premises, that no disturbance of soil within the ESMA is evident, and there is no evidence of land-use change (i.e., nearby residential construction). Interviews with the site property owner would include reviewing the owner's familiarity with restrictions imposed upon the property, and documentation of these restrictions; his knowledge of past excavations that may have been performed within the ESMA; and plans for property sale, development for residential use, or construction at the site. For FFS costing purposes, it is assumed that the institutional control inspections would be performed once per year. It is also assumed that institutional control inspections and environmental sampling might be performed by different entities and therefore separate site trips were costed.

Five-Year Site Reviews. Under CERCLA 121c, any remedial action that results in contaminants remaining on-site must be reviewed at least once every five years. During five-year site reviews, an assessment is made of whether the implemented remedy continues to be protective of human health and the environment or whether the implementation of additional remedial action is appropriate.

The five-year site review for Area 2 at AOC 57 would consist of evaluating the groundwater and surface water monitoring data and reviewing the ROD and site ARARs. The reports from the institutional control inspections would also be reviewed and, if applicable, the site would be visited and interviews performed to assess whether institutional controls are appropriate. The assumptions of the baseline risk assessment would be reviewed for appropriateness in light of available monitoring data, ARARs review, results of the site visit and interviews, and a conclusion made concerning the protectiveness of the remedy. The review would identify site area/media that no longer require monitoring and institutional controls. These areas would be recommended for no further action in the five-year site review report. For areas where groundwater or soil contaminant remain at concentrations above PRGs, the data and inspection reports would be evaluated to confirm that the implemented land-use restriction continues to be protective of human health. Emerging technologies that hold potential for remediating COCs in excess of PRGs would also be evaluated.

Consistent with guidance in OSWER Directive 9355.7-02A, the USEPA has recommended that five year reviews for Devens RFTA sites be performed simultaneously and reported in a single document. The first five-year site review for Devens RFTA sites with currently signed RODs requiring site reviews is scheduled for August 2000. Therefore, the five-year site review for AOC 57 will not be performed until the year 2005. Public meetings with the towns of Harvard and Ayer would likely be held coincident with these five-year site reviews to help keep the public informed of site status including its general condition, remaining contaminant levels, and protectiveness of the remedial

action.

6.1.2.1 Overall Protection of Human Health and the Environment. The human-health risk assessment identified risks in excess of USEPA's Superfund risk range and target HI from exposure to surface and subsurface soils and groundwater only for possible future land use and unrestricted land use scenarios, and not for current land use.

Aroclor-1260 and lead exceed possible future-use risk-based PRGs in soils. A deed restriction would be imposed at the site to restrict invasive activities within the surveyed ESMA. This deed restriction would minimize risk to construction workers from exposure to the COCs at concentrations exceeding possible future-use risk-based PRGs. Aroclor-1260, arsenic, chromium, EPH C11-C22 aromatic carbon range, and lead exceed unrestricted-use risk-based PRGs in surface and subsurface soils. A zoning or deed restriction would also be imposed at Area 2 wetlands to prohibit residential development. Residential prohibition would minimize risk to residential receptors from exposure to COCs at concentrations exceeding unrestricted-use risk-based PRGs.

Arsenic and PCE exceed unrestricted-use ARAR-based PRGs in groundwater. The zoning or deed restriction that prohibits residential development (to minimize soil exposure) would also include a restriction preventing installation of potable water wells in the wetland area and advisories for installation of potable water wells in the upland area. Therefore, Alternative II-2 will provide protection to human health. The ecological risk assessment did not identify unacceptable risks to the environment.

6.1.2.2 Compliance with ARARs. Alternative II-2 does not include actions that would actively reduce contaminant concentrations in site soils or groundwater, but does include controls to reduce the potential for human receptor exposure to contaminant concentrations, and environmental monitoring to confirm that groundwater ARARs are eventually achieved.

Chemical-specific ARARs. Chemical-specific ARARs triggered by Alternative II-2 are presented in Table 6-4. The same discussions pertaining to the chemical-specific ARARs, the former soil removal action and resultant improvement of groundwater conditions in Subsection 6.1.1.2 (Compliance with ARARs for the No Action Alternative) apply to Alternative II-2. Unlike the No Action Alternative, monitoring would be performed for Alternative II-2 to measure changes in contaminant concentrations or migration; therefore attainment of groundwater ARARs would eventually be confirmed at the two locations (57M-95-04A and 57P-98-02X), where MCL/MMCL exceedances have been detected.

Location-specific ARARs. No location-specific ARARs would be triggered by this alternative.

Action-specific ARARs. As listed in Table 6-6, investigation-derived waste (IDW) produced from groundwater sampling would be managed in accordance with USEPA

OSWER Publication 9345.3-03FS which is considered To be Considered Information.

6.1.2.3 Long-term Effectiveness and Permanence. Alternative II-2 provides institutional controls to restrict groundwater use and human receptor exposure to soils containing COCs that exceed PRGs. Long-term maintenance of these controls would be essential for long-term effectiveness.

This alternative does not provide active controls to reduce concentrations of COCs in soil or groundwater to PRGs at Area 2 wetlands. However, as discussed in Subsection 6.1.1.2, Compliance with ARARs (No Action), groundwater conditions are expected to continue to improve at the site as a result of the former soil removal action at the source area. PRGs (currently exceeded in only two groundwater monitoring wells) will eventually be achieved through diffusion and dispersion processes (arsenic and PCE) and by volatilization and biodegradation processes (PCE). Long-term environmental monitoring would assess the effectiveness and permanence of these processes in groundwater.

6.1.2.4 Reduction of Toxicity, Mobility, or Volume Through Treatment. Alternative II-2 does not employ active removal or treatment processes to address soil contamination; therefore, the alternative would not satisfy CERCLA's statutory preference for treatment as a principal component of remedial action. For reduction of toxicity and volume of groundwater COCs, this alternative relies principally on the natural processes of diffusion and dispersion following the former soil removal action to regain upgradient water quality (i.e., ORP) conditions. Regaining upgradient groundwater conditions will decrease the solubility of naturally occurring arsenic, the major risk contributor in groundwater at the site.

6.1.2.5 Short-term Effectiveness. Actions associated with Alternative II-2 include applying land-use restrictions and performing long-term environmental monitoring. When routinely implemented and checked, these actions protect site workers and the community until PRGs are achieved. Because this alternative does not provide active or intrusive remedial actions, this alternative would not pose a significant risk to the community, site workers, or the environment during implementation. A site-specific Health and Safety Plan (HASP) would minimize risks to site workers and adverse effects to the environment during groundwater and surface water sampling.

An approved Institutional Control Monitoring Plan and deed restrictions could be developed and implemented to achieve RAOs within approximately two to six months upon signing of the ROD. It is assumed that land-use restrictions pertaining to soil exposure, would be imposed indefinitely. Environmental sampling and land-use restrictions pertaining to groundwater exposure would be imposed until groundwater PRGs for unrestricted-use are achieved. An estimate pertaining to groundwater cleanup duration is discussed in greater detail in Paragraph 6.1.2.7 Cost.

6.1.2.6 Implementability. Because of the nature of remedial actions for this alternative, no adverse implementation issues are anticipated. Institutional controls should be easily implemented considering that the AOC 57 wetland area is slated for recreation/open space. The technology of environmental sampling and analysis is well demonstrated and readily available. Long-term monitoring and maintenance of institutional controls would be required to ensure effectiveness of this alternative. Alternative II-2 would not limit or interfere with the ability to perform future remedial actions.

6.1.2.7 Cost. Table 6-22 presents a summary of the estimated costs to implement Alternative II-2. The total NPW cost of the alternative is estimated to be $244,000. Over 90 percent of the total present worth costs associated with Alternative II-2 are related to long-term environmental monitoring and maintenance of institutional controls. Costs were developed assuming that land-use restrictions pertaining to soil exposure would be imposed indefinitely. As explained earlier in Section 6.0, a 30-year NPW cost is presented for alternatives with an indefinite implementation or cleanup period, as recommended by CERCLA guidance (USEPA, 1988). There is also considerable uncertainty pertaining to the duration that long-term environmental monitoring and groundwater-use deed restrictions would need to be imposed. These components would be required until groundwater PRGs for PCE and arsenic are achieved. This duration is principally dictated by the time required for subsidence of reducing conditions at the site that are enhancing the solubility of naturally-occurring arsenic. As previously discussed, the reducing conditions are created by the biodegradation of petroleum compounds at Area 2, which has likely been lessened as a result of the 1994 soil removal action. Given these uncertainties, a baseline cost was developed based on the conservative assumption that reducing conditions will persist for 30 years or greater for a comparison with the other alternatives. The effects of a reduced cleanup period was then evaluated as part of a cost sensitivity analysis and is discussed later within this subsection. A more refined estimate of cleanup duration may be possible upon collection of long-term groundwater monitoring data.

The following assumptions were used in estimating the baseline cost:

- There will be minimal difficulty in implementing zoning and/or deed restrictions.
- Institutional control inspections will be performed once per year.
- Environmental sampling will be performed twice per year for the first three years and once per year thereafter. Environmental sampling will be terminated upon obtaining groundwater PRG concentrations for three consecutive sampling events.
- Groundwater samples will be collected at five existing monitoring wells using low-flow sampling techniques.
- Surface water samples will be collected from four locations in Cold Spring Brook.
- Groundwater and surface water samples will be analyzed for arsenic and PCE (VOCs by USEPA Method 8260). Both filtered and unfiltered samples will be collected for arsenic.
- Quality control (QC) samples will be collected at a frequency of one per ten regular

samples (ten percent).

Cost-sensitivity Analysis. A cost-sensitivity analysis was performed to assess the effect of specific assumptions on the estimated cost of Alternative II-2. The greatest uncertainty in the cost estimate pertains to the duration that long-term environmental monitoring would need to be imposed. As previously discussed, environmental monitoring and groundwater-use deed restrictions would be required until groundwater PRGs for PCE and arsenic are achieved. Because of the uncertainty of this duration, costs for this alternative were evaluated for two extreme but possible monitoring durations (3 years and the baseline of 30 years). The minimum duration of 3 years was based on the assumption that the former removal action was successful at removing enough of the source that created the reducing conditions at the site. The minimum time for the groundwater to return to aerobic conditions is estimated as the time to flush out the pore volume of groundwater associated with the identified area of contamination. To be conservative, the calculation assumes that two pore volumes of flushing would be required. Two flushes would require 0.32 to 2 years at Area 2. The assumptions and calculations that serve as the basis for the flush time are provided in Appendix C. Given that the removal action occurred in 1994, background concentrations should have been achieved after 1996 (exceedance of the arsenic MCL still noted in 1998 sampling round). Although unlikely, PRGs will have already been achieved under this scenario when long-term monitoring is implemented. For the cost sensitivity assessment, it was therefore assumed that sampling would be performed twice per year for only three consecutive years as evidence that PRGs have been achieved. As shown in Table 6-22, a reduction in sampling duration decreases the overall cost for Alternative II-2 by approximately 40 percent ($244,000 down to $143,000).

Various other factors could have minor impacts on the cost of Alternative II-2. These include the number of monitoring wells and surface water samples to be collected, and the sampling frequency for environmental monitoring. These factors were considered but not included in the sensitivity analysis due to the lesser effect when compared to the variation in duration and the fact that the same factors (e.g., number of sampled locations, sample frequency) would be applied to each of the alternatives. The details of the LTMP will be completed following finalization of the FFS, selection of the preferred alternative and upon signing of the ROD. This FFS provides only an assumed long-term monitoring scope to facilitate evaluation of costs.

6.1.3 Alternative II-3: Excavation (For Possible Future Use) And Institutional Controls

Alternative II-3 is designed to reduce potential human-health risks associated with contaminated soil and groundwater at the Area 2 wetland. This alternative would consist of excavating contaminated soils to protect possible future-use (construction worker) receptors and implementing institutional controls to protect unrestricted-use (residential)

receptors. Environmental monitoring would be performed at the site to assess for groundwater COC migration. Five-year site reviews would be performed to ensure that the remedial alternative remains protective of human health and the environment. Alternative II-3 would consist of the following specific components:

- Wetlands Protection
- Soil Excavation and Treatment/Disposal at an Off-Site TSD Facility
- Institutional Controls
  - Land-use restrictions that prohibit residential use of wetland property and potable use of the aquifer
- Environmental Monitoring:
  - Long-term groundwater monitoring
  - Long-term surface water monitoring
- Institutional Control Inspections
- Five-year Site Reviews

Wetlands Protection. Wetland protection would likely be required as a result of potential wetland impacts from excavation activities. Protection would be in accordance with the Massachusetts Wetland Protection Act and Regulations, specifically 310 CMR 10.55. Construction work would be within the 100-year flood plain (228 feet msl) and would probably be within the delineated bordering vegetated wetland based on a 1993 wetlands delineation (depicted in Figure 3-3). As a precursor to remedial activities, the wetlands at Area 2 would be redelineated. If the proposed construction area is confirmed to be within delineated vegetated wetlands, a pre-construction mitigation study would be performed to determine the impact to the affected area and the compensatory mitigation required as a result of the excavation activities. Once the extent of anticipated impacts is known, a mitigation plan would be prepared for agency review and approval.

The primary goal of wetland restoration activities at Lower Cold Spring Brook and adjacent wetlands would be to restore self-sustaining freshwater wetlands in situ (i.e., in the same "footprint" as the altered wetlands). The surface area of the restored wetland would be equal to or greater than that of the altered wetland. Depending on federal and state regulatory guidance, as well as financial and temporal considerations, a number of diverse approaches exist to restore self-sustaining wetlands. At a minimum, wetland restoration would include backfilling with suitable material to achieve desired grade and controlling erosion and siltation. At the other extreme, wetland restoration could involve the above activities, plus transplanting or purchasing nursery stock to partially of fully revegetate the altered wetland. During construction, erosion control measures such as soil berms, silt fencing and hay bales would be used to protect against erosion and siltation within the floodplain area. Final backfilled excavation grades would be required to match existing grade. Compensatory mitigation and monitoring would be implemented according to the approved mitigation plan. A wetland scientist would monitor wetlands restoration for a period of five years, beginning the year after the wetlands creation.

Soil Excavation and Treatment/Disposal at an Off-Site TSD. Alternative II-3 would entail excavating wetland soils that exceed possible future-use PRGs for protection of the construction worker receptor. Area and depth of the excavation would include soils with Aroclor-1260 and lead concentrations in excess of PRGs that are considered protective of possible future use (recreational/construction). The in-place volume of soil to be excavated is estimated to be approximately 640 cy. The estimated areal extent of soil contamination to be excavated is shown in Figure 3-1 based on observed PRG exceedances. Based upon depth of an organic soil layer observed during the RI, it is assumed that the average depth of contaminated soil would extend down to approximately 4 feet bgs.

As part of the remedial design, predesign confirmation soil sampling would be performed within the 1994 Area 2 Soil Removal Area to demonstrate that the soil within the former excavation does not contain Aroclor-1260 and lead concentrations above PRGs. Sampling would focus at areas where elevated contaminant levels were reported upon the conclusion of the 1994 Removal Action. Details of the proposed confirmation sampling program within the former excavation area would be included as part of the remedial design for review by the regulatory agencies. Prior to excavation, a soil berm, siltation fence and/or hay bales will be positioned downgradient of the proposed excavation area to minimize migration of contaminated soils and siltation of Cold Spring Brook wetland. A temporary stockpile area would be constructed for dewatering of saturated soils and stockpiling for soil characterization. For cost estimating purposes, it is assumed that the stockpile area would be an approximate 50 feet by 100 feet bermed area constructed with an impervious liner. It is also assumed that the stockpile area would be located at an existing cleared area approximately 150 feet northeast of Area 2. Precipitation and/or supernatant water from saturated soils would be pumped from low points of the containment area into frac tanks and sampled. At a minimum, sampling would be in accordance with the Sewer Use Rules and Regulations for the Devens Sewerage Service Area (MassDevelopment, 1998). Water meeting the Devens Sewer Use Rules and Regulations would be discharged to the sanitary sewer. Water that exceeds the Devens sewer use regulations would be treated off-site. Devens sewer discharge limitations of likely concern at AOC 57 include 0.30 milligrams per liter (mg/L) arsenic, 0.038 mg/L cadmium, 400 mg/L total suspended solids, 5.0 mg/L total toxic organics, and 100 mg/L total petroleum hydrocarbons.

Soil excavation would be completed using conventional construction equipment such as an extended reach tracked excavator, a front-end loader and dump trucks. Large pieces of debris or rocks would be separated from soil, visibly cleaned of soil and likely be used as backfill. For FFS costing purposes, it is assumed that the extent of excavation would be guided using on-site field-screening methods and final cleanup confirmed using off-site analytical methods (USEPA Methods 6010 and 8082 for lead and PCBs, respectively). Groundwater encountered in the excavation will be removed by creating a sump in a corner of the excavation. This remediation wastewater will be pumped from the

excavation, and into a temporary on-site frac tank and sampled as above. Refer to Subsection 6.1.3.7 for additional assumptions used in preparing the cost for Alternative II-3.

Institutional Controls. Institutional controls in the form of land-use restrictions would limit residential use of the wetland portion of Area 2. Unlike, Alternative II-2, deed restrictions pertaining to invasive construction activities at the Area 2 wetland would not be required for Alternative II-3 because the soil excavation component would remove COCs that exceed possible-future-use PRGs. However, land-use restrictions, as described for Alternative II-2 (Subsection 6.1.2), in the form of zoning or deed restrictions would still be imposed to prohibit residential development to prevent residential contact with contaminated soil and well installation for potable use in wetland areas (for protection from unrestricted-use soil and groundwater exposures), and to implement advisories for potable well installations in the adjacent upland Area 2 as discussed in Alternative II-2.

Environmental Monitoring. Environmental monitoring would consist of performing long-term groundwater and surface water sampling as described for Alternative II-2 (Subsection 6.1.2).

Institutional Control Inspections. Regularly scheduled inspections would be performed to confirm that land-use restrictions in the form of deed or zoning restrictions are implemented to minimize potential human exposure to soil and groundwater COCs left at the site. An Institutional Control Monitoring Plan would be prepared and inspections performed as described for Alternative II-2 (Subsection 6.1.2) except that the inspection/interview elements pertaining to construction and/or disturbance of soil within the Area 2 wetland would not apply. Because the soil excavation component of Alternative II-3 would remove COCs that exceed possible-future-use PRGs, deed restrictions, and subsequent inspections/interviews, pertaining to invasive construction activities at the Area 2 wetland would not be required.

Five-Year Site Reviews. Five-year site reviews would be performed as described for Alternative II-2 (Subsection 6.1.2).

6.1.3.1 Overall Protection of Human Health and the Environment. The human-health risk assessment identified risks in excess of USEPA's Superfund risk range and target HI from exposure to surface and subsurface soils and groundwater only for possible future land use and unrestricted land use scenarios, and not for current land use.

Aroclor-1260 and lead exceed possible future-use risk-based PRGs in soils. Soil with COCs exceeding these PRGs would be excavated and treated/disposed off-site, thus minimizing risk to the construction worker receptor. Aroclor-1260, arsenic, chromium, EPH C11-C22 aromatic carbon range, and lead exceed unrestricted-use risk-based PRGs in surface and subsurface soils. A zoning or deed restriction would be imposed at Area 2 wetlands to prohibit residential development. Residential prohibition would minimize

risk to residential receptors from exposure to COCs at concentrations exceeding unrestricted-use PRGs.

Arsenic and PCE exceed unrestricted-use ARAR-based PRGs in groundwater. The zoning or deed restriction that prohibits residential development (to minimize soil exposure) would also include a restriction preventing installation of water wells for potable use in the wetland area and advisories for installation of water wells for potable use in the upland area. Therefore, Alternative II-3 will provide protection to human health. The ecological risk assessment did not identify unacceptable risks to the environment.

6.1.3.2 Compliance with ARARs. Alternative II-3 includes actions that would actively reduce contaminant concentrations in site soils, but not groundwater. The alternative does include controls to reduce the potential for human receptor exposure to contaminant concentrations in groundwater, and environmental monitoring to confirm that groundwater ARARs are eventually achieved.

<u>Chemical-specific ARARs.</u> Chemical-specific ARARs triggered by Alternative II-3 are presented in Table 6-7. The same discussions pertaining to the chemical-specific ARARs, the former soil removal action and resultant improvement of groundwater conditions in Subsection 6.1.1.2 (Compliance with ARARs for the No Action Alternative) apply to Alternative II-3. Although not readily quantifiable, the proposed excavation of soils as a component of Alternative II-3 is likely to expedite improvements to groundwater conditions. Monitoring would be performed for Alternative II-3 to measure changes in contaminant concentrations or migration; therefore attainment of groundwater ARARs would eventually be confirmed at the two locations (57M-95-04A and 57P-98-02X), where MCL/MMCL exceedances have been detected.

<u>Location-specific ARARs.</u> Location-specific ARARs triggered by Alternative II-3 are presented in Table 6-8. Federal and state regulations pertaining to the protection of wetland and floodplain areas would be triggered because of the soil removal activities that would be performed in the vicinity of Lower Cold Spring Brook. Soil removal would be performed to minimize alteration/destruction of the floodplain/wetland areas and would require restoration. Protection of endangered species may also need to be considered during the design and implementation of this alternative. The RI report identified several state-listed rare, threatened, or endangered species occurring within one mile of AOC 57. However, the actual occurrence of these species at the site is unknown. The following species may be found in the wooded portions of AOC 57, or in Cold Spring Brook and its floodplain: Blanding's turtle (*Emydoidea blandingii*) (threatened), eastern box turtle (*Terrapene carolina*) (special concern), wood turtle (special concern), and ovate spike-sedge (*Eleocharis obtusa* var. *ovata*) (endangered). The following species may be found in the upland sandy soils or disturbed portions of AOC 57: Houghton's flatsedge (*Cyperus houghtonii*) (endangered), New England blazing star (*Liatris scariosa* var. *novae-*

angliae) (special concern), and wild senna (*Senna hebecarpa*) (endangered).

Action-specific ARARs. Action-specific ARARs triggered by Alternative II-3 are presented in Table 6-9. Federal and state regulations pertaining to the handling, transportation and disposal of solid and hazardous wastes would be triggered because of the soil removal activities that would be performed as a component of Alternative II-3. Construction activities would also be controlled to meet federal and state regulations pertaining to the control of surface water runoff, and protection of surface water and air quality.

6.1.3.3 Long-term Effectiveness and Permanence. Removal of soils containing COCs that exceed possible future-use PRGs would effectively and permanently minimize risk to the construction worker receptor. However, COCs that exceed unrestricted-use PRGs would remain on-site, posing possible risk to residential receptors. Alternative II-3 provides institutional controls to restrict residential exposure to soils containing COCs that exceed PRGs. Long-term maintenance of these controls would be essential for long-term effectiveness.

This alternative does not provide active controls to reduce concentrations of COCs in groundwater at Area 2 wetlands. However, as discussed in Subsection 6.1.1.2, Compliance with ARARs (No Action), groundwater conditions are expected to continue to improve at the site as a result of the former soil removal action at the source area. PRGs (currently exceeded in only two groundwater monitoring wells) will eventually be achieved through diffusion and dispersion processes (arsenic and PCE) and by volatilization and biodegradation processes (PCE). Long-term environmental monitoring would assess the effectiveness and permanence of these processes in groundwater. Until groundwater PRGs are achieved, Alternative II-3 provides institutional controls to restrict residential exposure to groundwater containing COCs that exceed unrestricted-use PRGs.

6.1.3.4 Reduction of Toxicity, Mobility, or Volume Through Treatment. Alternative II-3 employs active removal processes and off-site treatment/disposal at a licensed TSD facility to address soil contamination; therefore, the alternative would satisfy CERCLA's statutory preference for treatment as a principal component of remedial action. However, COCs exceeding unrestricted-use PRGs would still remain at Area 2 wetland soils. For reduction of toxicity and volume of groundwater COCs, this alternative relies principally on the natural processes of diffusion and dispersion following the former soil removal action to regain upgradient water quality (i.e., ORP) conditions. Regaining upgradient groundwater conditions will decrease the solubility of naturally occurring arsenic, the major risk contributor in groundwater at the site.

6.1.3.5 Short-term Effectiveness. Actions associated with Alternative II-3 include soil excavation and transportation, applying land-use restrictions and performing long-term environmental monitoring.

Short-term risks to the community from excavation activities would be minimal during implementation of this alternative because there are no residences near AOC 57. Risks to workers would be primarily from incidental ingestion of soils. Personal protective equipment would be required to minimize risk to workers during excavation. Engineering controls to limit dust generation would also be implemented to minimize exposure to downwind receptors. Soils would be transported to the TSD facility following federal and state regulations. The soil excavation is expected to take approximately 1 to 2 weeks to complete.

Land-use restrictions, when routinely implemented and checked, protect site workers and the community. An approved Institutional Control Monitoring Plan and deed restrictions could be developed and implemented to achieve RAOs within approximately two to six months upon signing of the ROD. It is assumed that land-use restrictions pertaining to soil exposure, would be imposed indefinitely.

A site-specific Health and Safety Plan (HASP) would minimize risks to site workers and adverse effects to the environment during groundwater and surface water sampling. Environmental sampling and land-use restrictions pertaining to groundwater exposure would be imposed until groundwater PRGs for unrestricted-use are achieved. An estimate pertaining to groundwater cleanup duration is discussed in greater detail in Paragraph 6.1.3.7 Cost.

6.1.3.6 Implementability. Excavation at Area 2 wetlands is readily implementable using standard construction practices. Excavation may extend to or slightly below the water table so that dewatering may be necessary. Wetland protection and restoration will also likely be required due to wetlands disturbance from soil removal activities. Federal, state, and licensing requirements of the TSD will govern off-site soil transportation, treatment and disposal. Institutional controls should be easily implemented considering that the AOC 57 wetland area is slated for recreation/open space. The technology of environmental sampling and analysis are well demonstrated and readily available. Long-term monitoring and maintenance of institutional controls would be required to ensure effectiveness of this alternative. Alternative II-3 would not limit or interfere with the ability to perform future remedial actions.

6.1.3.7 Cost. Table 6-23 presents a summary of the estimated costs to implement Alternative II-3. The total NPW cost of the alternative is estimated to be $667,000. Approximately 60 percent of this cost is related to the capital cost associated with excavation. Costs were developed assuming that land-use restrictions pertaining to soil exposure would be imposed indefinitely. As explained earlier in Section 6.0, a 30-year NPW cost is presented for alternatives with an indefinite implementation or cleanup period, as recommended by CERCLA guidance (USEPA, 1988). As discussed in Subsection 6.1.2.7, Cost for Alternative II-2, there is considerable uncertainty pertaining to the duration that long-term environmental monitoring and groundwater-use deed

restrictions would need to be imposed. As with Alternative II-2, a baseline cost was developed based on the conservative assumption that reducing conditions will persist for 30 years or greater for a comparison with the other alternatives. The effects of a reduced cleanup period was then evaluated as part of a cost sensitivity analysis and is discussed later within this subsection.

The following assumptions were used in estimating the baseline cost:

- Predesign sampling within the former excavation area would consist of collecting approximately 36 soil samples with a geoprobe and analysis of the COCs.
- Approximately 640 cy (1,152) tons of soil will be excavated. The soil volume estimated to be excavated at Area 2 is based on the assumption that the COCs detected within the former excavation area will be below the PRGs.
- Approximately ¼ of the excavated soil (288 tons) will require disposal as a hazardous waste while ¾ of the excavated soil (864 tons) may be disposed as MA99 waste under a MADEP Bill of Lading (BOL).
- The lined stockpile/dewatering area will be approximately 50 feet by 100 feet.
- Water in the excavation and leachate from the stockpiles will be collected and treated off-site.
- The extent of excavation would be guided using on-site field-screening methods, specifically USEPA Method 4020 immuno-assay testing for PCBs and x-ray fluorescence for lead.
- Approximately 27 confirmation samples will be collected (one sample per 900 sq. ft of floor area, one sample per 30 feet of wall length) and analyzed off-site.
- Off-site analytical costs assume 3-day turn-around-time for USEPA Method 6010 and 8082 for lead and PCBs, respectively.
- There will be minimal difficulty in implementing zoning and/or deed restrictions.
- Institutional control inspections will be performed once per year.
- Environmental sampling will be performed twice per year for the first three years and once per year thereafter. Environmental sampling will be terminated upon obtaining groundwater PRG concentrations for three consecutive sampling events.
- Groundwater samples will be collected at five existing monitoring wells using low-flow sampling techniques.
- Surface water samples will be collected from four locations in Cold Spring Brook.
- Groundwater and surface water samples will be analyzed for arsenic and PCE (VOCs by USEPA Method 8260). Both filtered and unfiltered samples will be collected for arsenic.
- QC samples will be collected at a frequency of one per ten regular samples (ten percent).

Cost-sensitivity Analysis. A cost-sensitivity analysis was performed to assess the effect of specific assumptions on the estimated cost of Alternative II-3. As with Alternative II-2, the greatest uncertainty in the cost estimate pertains to the duration that long-term environmental monitoring and groundwater-use deed restrictions would need to be

imposed. Costs for this alternative were evaluated for a range in environmental monitoring duration (3 and 30 years). Refer to the cost sensitivity discussion in paragraph 6.1.2.7 and Appendix C, regarding monitoring duration derivation.

Another uncertainty in the cost estimate pertains to the volume of soil that will require excavation to achieve possible future-use PRGs, specifically in regard to excavation depth. If the average depth of excavation of the area shown in Figure 3-1 varies by +/-1 foot, the total volume excavated will change by +/- 25 percent changing soil/excavation, transportation and TSD costs, proportionally.

Decreasing the environmental sampling duration to 3 years decreases the total O&M present worth cost by approximately 44 percent, while varying the quantity of soil excavated by +/- 25 percent, changes the total capital cost by approximately 12 percent. The low range costs (25 percent less soil excavated and 3 years of environmental monitoring) and high range costs (25 percent greater soil excavated and 30 year cleanup duration) are presented in Table 6-23. Low-range and high-range costs ($515,000 and $719,000) varied from the baseline present worth cost by approximately 23 percent and 8 percent, respectively.

Refer to the cost sensitivity discussion for Alternative II-2 in Subsection 6.1.2.7, pertaining to other factors could also have minor impacts on the cost of Alternative II-3. These factors were considered but not included in the sensitivity analysis due to the lesser effect.

6.1.4 Alternative II-4: Excavation (For Unrestricted-Use) And Institutional Controls

Alternative II-4, is designed to reduce potential human-health risks associated with contaminated soil and groundwater at the Area 2 wetland. This alternative would consist of excavating contaminated soils to protect unrestricted-use (residential) receptors and implementing institutional controls to protect unrestricted-use (residential) receptors from contaminated groundwater. Environmental monitoring would be performed at the site to assess for groundwater COC migration. Five-year site reviews would be performed to ensure that the remedial alternative remains protective of human health and the environment. Alternative II-4 would consist of the following specific components:

- Wetlands Protection
- Soil Excavation and Treatment/Disposal at an Off-Site TSD Facility
- Institutional Controls
  - Land-use restrictions that prohibit residential use of wetland aquifer
- Environmental Monitoring:
  - Long-term groundwater monitoring
  - Long-term surface water monitoring

- Institutional Control Inspections
- Five-year Site Reviews

Wetlands Protection. Wetland protection would likely be required as a result of potential wetland impacts from excavation activities as discussed for Alternative II-3.

Soil Excavation and Treatment/Disposal at an Off-Site TSD. Alternative II-4 would entail excavating wetland soils that exceed unrestricted-use PRGs for protection of residential receptors. Area and depth of the excavation would include soils with Aroclor-1260, arsenic, chromium, EPH C11-C22 aromatic carbon range, and lead concentrations in excess of PRGs that are considered protective of unrestricted use (residential). The in-place volume of soil to be excavated is estimated to be approximately 1,800 cy. The estimated areal extent of soil contamination to be excavated is shown in Figure 3-3 based on observed PRG exceedances. Based upon depth of an organic soil layer observed during the RI, it is assumed that the average depth of contaminated soil would extend down to approximately 4 feet bgs.

As with Alternative II-3, predesign confirmation soil sampling would first be performed within the 1994 Area 2 Soil Removal Area to demonstrate that the soil within the former excavation does not contain COC exceedances above PRGs. Sampling would be performed for Aroclor-1260, arsenic, chromium, lead, and EPH C11-C22 and details of the program would be submitted for regulatory approval prior to implementation. Excavation activities would be performed as detailed for Alternative II-3 in Subsection 6.1.3 FFS costing purposes, it is assumed that the extent of excavation would be guided using on-site field-screening methods and final cleanup confirmed using off-site analytical methods (USEPA Methods 6010, 8082, and MADEP EPH Method), for the inorganics, PCBs, and EPH C11-C22 carbon range respectively). Groundwater encountered in the excavation will be removed by creating a sump in a corner of the excavation. This remediation wastewater will be pumped from the excavation, and into a temporary on-site frac tank and sampled for disposal options. Precipitation and/or supernatant water from saturated soil stockpiles would be pumped from low points of the containment area into frac tanks and sampled. At a minimum, sampling would be in accordance with the Sewer Use Rules and Regulations for the Devens Sewerage Service Area (MassDevelopment, 1998) as discussed in Subsection 6.1.3 for Alternative II-3 for Area 2. Refer to Subsection 6.1.4.7 for additional assumptions used in preparing the cost for Alternative II-4.

Institutional Controls. Institutional controls in the form of land-use restrictions would limit residential use of the wetland portion of Area 2. Unlike, Alternative II-2 and Alternative II-3, deed restrictions pertaining to invasive construction activities and residential use of Area 2 wetland soils would not be required for Alternative II-4 because the soil excavation component would remove COCs that exceed residential-use PRGs. However, land-use restrictions, as described for Alternative II-3 (Subsection 6.1.3), in the form of zoning or deed restrictions would still be imposed to prohibit well installation for potable use in

wetland areas and advisories for installation of water wells for potable use in the upland area.

Environmental Monitoring. Environmental monitoring would consist of performing long-term groundwater and surface water sampling as described for Alternative II-2 (Subsection 6.1.2).

Institutional Control Inspections. Regularly scheduled inspections would be performed to confirm that land-use restrictions in the form of deed or zoning restrictions are implemented to minimize potential human exposure to groundwater COCs left at the site. An Institutional Control Monitoring Plan would be prepared and inspections performed as described for Alternative II-2 (Subsection 6.1.2) except that the inspection/interview elements pertaining to construction worker or residential exposure to soils at the Area 2 wetland would not apply. Because the soil excavation component of Alternative II-4 would remove COCs that exceed unrestricted-use PRGs, only deed restrictions, and subsequent inspections/interviews, pertaining prohibition of residential use of the Area 2 wetland aquifer would apply.

Five-Year Site Reviews. Five-year site reviews would be performed as described for Alternative II-2 (Subsection 6.1.2).

6.1.4.1 Overall Protection of Human Health and the Environment. The human-health risk assessment identified risks in excess of USEPA's Superfund risk range and target HI from exposure to surface and subsurface soils and groundwater only for possible future land use and unrestricted land use scenarios, and not for current land use.

Aroclor-1260 and lead exceed possible future-use risk-based PRGs in soils. Aroclor-1260, arsenic, chromium, EPH C11-C22 aromatic carbon range, and lead exceed unrestricted-use risk-based PRGs in surface and subsurface soils. Soil with COCs exceeding the unrestricted-use PRGs would be excavated and treated/disposed off-site, thus minimizing risk to both the construction worker (possible future-use) and residential (unrestricted-use) receptor.

Arsenic and PCE exceed unrestricted-use ARAR-based PRGs in groundwater. A zoning or deed restriction prohibiting installation of water wells for potable use would be implemented to reduce risk to exposure to contaminated groundwater in wetland areas. Advisories for installation of water wells for potable use would be implemented for upland areas. Alternative II-4 will provide protection to human health. The ecological risk assessment did not identify unacceptable risks to ecological receptors from exposure to sediments or surface water.

6.1.4.2 Compliance with ARARs. Alternative II-4 includes actions that would actively reduce contaminant concentrations in site soils, but not groundwater. The alternative

does include controls to reduce the potential for human receptor exposure to contaminant concentrations in groundwater, and environmental monitoring to confirm that groundwater ARARs are eventually achieved.

Chemical-specific ARARs. Chemical-specific ARARs triggered by Alternative II-4 are presented in Table 6-10. The same discussions pertaining to the chemical-specific ARARs, the former soil removal action and resultant improvement of groundwater conditions in Subsection 6.1.1.2 (Compliance with ARARs for the No Action Alternative) apply to Alternative II-4. As with Alternative II-3, the proposed excavation of soils as a component of Alternative II-4 is likely to expedite improvements to groundwater conditions, although this benefit is not readily quantifiable. Monitoring would be performed for Alternative II-4 to measure changes in contaminant concentrations or migration; therefore attainment of groundwater ARARs would eventually be confirmed at the two locations (57M-95-04A and 57P-98-02X), where MCL/MMCL exceedances have been detected.

Location- and Action-specific ARARs. Location- and action-specific ARARs triggered by Alternative II-4 are presented in Table 6-11 and 6-12, respectively. Discussion pertaining to location- and action-specific ARARs in Subsection 6.1.3.2 for Alternative II-3 also applies to Alternative II-4.

6.1.4.3 Long-term Effectiveness and Permanence. Removal of soils containing COCs that exceed unrestricted-use PRGs would effectively and permanently minimize risk to the construction worker and residential receptor. Unlike Alternatives II-2 and II-3, no institutional controls to minimize human exposure to soils would be needed.

This alternative does not provide active controls to reduce concentrations of COCs in groundwater at Area 2 wetlands. However, as discussed in Subsection 6.1.1.2, Compliance with ARARs (No Action), groundwater conditions are expected to continue to improve at the site as a result of the former soil removal action at the source area. PRGs (currently exceeded in only two groundwater monitoring wells) will eventually be achieved through diffusion and dispersion processes (arsenic and PCE) and by volatilization and biodegradation processes (PCE). Long-term environmental monitoring would assess the effectiveness and permanence of these processes in groundwater. Until groundwater PRGs are achieved, Alternative II-4 provides institutional controls to restrict residential exposure to groundwater containing COCs that exceed unrestricted-use PRGs.

6.1.4.4 Reduction of Toxicity, Mobility, or Volume Through Treatment. Alternative II-4 employs active removal processes and off-site treatment/disposal at a licensed TSD facility to address soil contamination; therefore, the alternative would satisfy CERCLA's statutory preference for treatment as a principal component of remedial action. For reduction of toxicity and volume of groundwater COCs, this alternative relies principally on the natural processes of diffusion and dispersion following the former soil removal action to regain upgradient water quality (i.e., ORP) conditions. Regaining upgradient

groundwater conditions will decrease the solubility of naturally occurring arsenic, the major risk contributor in groundwater at the site.

6.1.4.5 Short-term Effectiveness. Actions associated with Alternative II-4 include soil excavation and transportation, applying land-use restrictions and performing long-term environmental monitoring.

Short-term risks to the community and remedial workers from excavation activities and environmental sampling would be as previously discussed for Alternative II-3 in Subsection 6.1.3.5. The soil excavation is expected to take approximately 2 to 4 weeks to complete. An estimate pertaining to groundwater cleanup duration is discussed in greater detail in Paragraph 6.1.4.7 Cost.

6.1.4.6 Implementability. Discussion pertaining to the implementation of Alternative II-3 in paragraph 6.1.3.6 also applies to Alternative II-4. Excavation at Area 2 wetlands is readily implementable using standard construction practices and would not limit or interfere with the ability to perform future remedial actions.

6.1.4.7 Cost. Table 6-24 presents a summary of the estimated costs to implement Alternative II-4. The total NPW cost of the alternative is estimated to be $1,321,000. Approximately 80 percent of this cost is related to the capital cost associated with excavation. Costs were generated based on similar assumptions and uncertainties as discussed for Alternative II-3 in Subsection 6.1.3.7. As with the previous alternatives, a baseline cost was developed based on the conservative assumption that reducing conditions will persist for 30 years or greater for a comparison with the other alternatives. The effects of a reduced cleanup period was then evaluated as part of a cost sensitivity analysis and is discussed later within this subsection.

The following assumptions were used in estimating the baseline cost:

- Predesign sampling within the former excavation area would consist of collecting approximately 36 soil samples with a geoprobe and analysis of the COCs.
- Approximately 1,800 cy (3,240) tons of soil will be excavated. The soil volume estimated to be excavated at Area 2 is based on the assumption that the COCs detected within the former excavation area will be below the PRGs.
- Approximately ¼ of the excavated soil (810 tons) will require disposal as a hazardous waste while ¾ of the excavated soil (2,430 tons) may be disposed as MA99 waste under a MADEP BOL.
- The lined stockpile/dewatering area will be approximately 50 feet by 200 feet.
- Water in the excavation and leachate from the stockpiles will be collected and treated off-site.
- Monitoring wells 57M-95-04A and 57M-95-04B will likely be removed/disturbed during soil excavation activities and will require reinstallation and development.

- The extent of excavation will be guided by field screening methods, specifically USEPA Method 4020 and 4035 immuno-assay testing for PCBs and EPH C11-C22 carbon range, respectively; and x-ray fluorescence for lead, chromium and arsenic.
- Approximately 50 confirmation samples will be collected (one sample per 900 sq. ft of floor area and one sample per 30 feet of wall length) and analyzed off-site.
- Off-site analytical costs assume 3-day turn-around-time for USEPA Methods 6010, 8082, and MADEP EPH Method (for the inorganics, PCBs, and EPH C11-C22 carbon range respectively).
- There will be minimal difficulty in implementing zoning and/or deed restrictions.
- Institutional control inspections will be performed once per year.
- Environmental sampling will be performed twice per year for the first three years and once per year thereafter. Environmental sampling will be terminated upon obtaining groundwater PRG concentrations for three consecutive sampling events.
- Groundwater samples will be collected at five existing monitoring wells using low-flow sampling techniques.
- Surface water samples will be collected from four locations in Cold Spring Brook.
- Groundwater and surface water samples will be analyzed for arsenic and PCE (VOCs by USEPA Method 8260). Both filtered and unfiltered samples will be collected for arsenic.
- QC samples will be collected at a frequency of one per ten regular samples (ten percent).

Cost-sensitivity Analysis. A cost-sensitivity analysis was performed to assess the effect of specific assumptions on the estimated cost of Alternative II-4. As with Alternatives II-2 and II-3, one of the greater uncertainties in the cost estimate pertains to the duration that long-term environmental monitoring and groundwater-use deed restrictions would need to be imposed. Costs for this alternative were evaluated for a range in environmental monitoring duration (3 and 30 years). Refer to the cost sensitivity discussion in paragraph 6.1.2.7 and Appendix C, regarding monitoring duration derivation.

As with Alternative II-4, another uncertainty in the cost estimate pertains to the volume of soil that will require excavation to achieve possible future-use PRGs, specifically in regard to depth. If the average depth of excavation of the area shown in Figure 3-1 varies by +/-1 foot, the total volume excavated will change by +/- 25 percent changing soil/excavation, transportation and TSD costs, proportionally.

Decreasing the environmental sampling duration, and institutional control inspections to 3 years, and 5-year site review to one 5-year period decreases the total O&M present worth cost by approximately 65 percent. Varying the quantity of soil excavated by +/- 25 percent, changes the total capital cost by approximately 14 percent. The low range costs (25 percent less soil excavated and 3 years of environmental monitoring) and high range costs (25 percent greater soil excavated and 30-year cleanup duration) are presented in Table 6-24. Low-range and high-range costs ($1,028,000 and $1,466,000) varied from the baseline present worth cost by approximately 24 percent and 12 percent, respectively.

Refer to the cost sensitivity discussion for Alternative II-2 in Subsection 6.1.2.7, pertaining to other factors could also have minor impacts on the cost of Alternative II-3. These factors were considered but not included in the sensitivity analysis due to the lesser effect.

6.2 DETAILED ANALYSIS OF AREA 3 UPLAND/WETLAND ALTERNATIVES

This subsection provides a detailed description, includes a cost estimate, and evaluates the alternative using the seven evaluation criteria for each alternative retained for Area 3 Upland/Wetland.

6.2.1 Alternative III-1: No Action

Alternative III-1, the No Action Alternative was retained as a baseline with which to compare the other alternatives, as required by the NCP. Remedial action, monitoring, further investigations, and site reviews would not be conducted as part of this alternative. The following assessment of the No Action Alternative is based on the first seven evaluation criteria presented in Table 1-1.

6.2.1.1 Overall Protection of Human Health and the Environment. The human-health risk assessment identified risks in excess of USEPA's Superfund risk range and target HI from exposure to surface soils and groundwater only for possible future land use and unrestricted land use scenarios, and not for current land use. The EPH C11-C22 aromatic carbon range concentration exceeds its risk-based PRG in wetland soils only. Arsenic, cadmium, and 1,4-DCB exceed ARAR-based PRGs in upland groundwater. Arsenic and PCE exceed ARAR-based PRGs in wetland groundwater. The ecological risk assessment did not identify unacceptable risks to ecological receptors from exposure to sediments or surface water. Therefore, the No Action Alternative will not provide protection to human health but will be protective of the environment.

6.2.1.2 Compliance with ARARs. The No Action Alternative would not include any actions to reduce contaminant concentrations in site soils or groundwater. Although the soil contaminants would remain on site, soil PRGs were not established using promulgated guidance values and therefore are not considered ARARs.

Chemical-specific ARARs triggered by Alternative III-1 are presented in Table 6-13. Groundwater COCs that exceed chemical-specific ARARs (e.g., MCLs and MMCLs) are arsenic, cadmium, and 1,4-DCB in upland groundwater and arsenic and PCE in wetland groundwater. Chemical-specific ARARs would not be met by this alternative in the short-term, but may be met by natural attenuation processes in the long-term. As with

Area 2, there are only a few marginal exceedances of MCLs/MMCLs in the upland and wetland groundwater at Area 3. MCL/MMCL exceedances appear to be generally discrete occurrences rather than a continuous "plume" as evidenced by the sporadic or marginal exceedances of MCL/MMCLs detected in only 57M-95-03X and 57M-96-11X. In 57M-95-03X, arsenic exceeded its MCL/MMCL in November 1995 but not in subsequent rounds (February 1996 and October 1996), and cadmium and 1,4-DCB exceeded MCL/MMCLs only in October 1996 and not in previous rounds (November 1995 and February 1996). In 57M-96-011X, arsenic exceeded its MCL/MMCL in both the October 1996 and May 1998 rounds, while PCE exceeded its MCL/MMCL only in the May 1998. This suggests that there is not a significant area (or volume) of groundwater requiring cleanup.

Arsenic is the major risk contributor in groundwater at Area 3 (see Tables 3-1 and 3-2). Although there were sporadic detections of arsenic in surface soils at AOC 57 above its background concentration, no apparent disposal areas or source areas of arsenic were identified during the RI. As discussed in Subsection 4.1, the detection of arsenic in groundwater is more likely caused by leaching of naturally occurring arsenic from the petroleum-contaminated soils. Reducing conditions, created by the biodegradation of petroleum compounds, enhance leaching of naturally occurring arsenic from soil to groundwater. The soil removal action performed in 1999 at Area 3 has significantly reduced petroleum contamination in soil, thereby mitigating the leaching of naturally occurring arsenic.

The soil removal action has also likely removed any potential continuing sources in soil contributing to cadmium, 1,4-DCB, and PCE groundwater MCL/MMCL exceedances. Cadmium was detected in soil at only three locations above its background concentration (57B-96-07X at 10.8 mg/kg, 57B-96-08X at 1.5 mg/kg, and 57E-95-24X at 5.14 mg/kg). Two of the three locations were removed during the 1999 soil removal; the third location, 57B-96-08X is only marginally above background and would not contribute to MCL/MMCL exceedance in groundwater. Similarly, RI soil sampling results reveal only sporadic and trace concentrations of residual PCE in soil. The maximum detected concentration, 0.0094 mg/kg in 57E-96-28X, is well below the MCP S-1/GW-1 standard of 0.5 mg/kg that is considered protective of groundwater. All detections of PCE in soil during the RI at Area 3 were within borings/test pits within the area eventually excavated in 1999. Similarly, 1,4-dichlorobenezene was detected at 14 mg/kg (on-site analysis) and 2 mg/kg (offsite analysis) in 57B-96-07X, at 1.6 mg/kg and 2.2 mg/kg (both on-site analyses) in 57R-96-15X (5 feet and 9 feet, respectively), 4 mg/kg (off-site analysis) in 57E-96-28X, and 0.48 mg/kg (off-site analysis) in 57S-98-13X. With the exception of the low detection of 1,4-dichlorobenezene in 57S-98-13X, all these sampled locations were within the area eventually excavated in 1999.

As a result of the 1999 excavation, groundwater conditions are expected to continue to improve at the site through natural diffusion and dispersion processes and the few unattained ARARs are anticipated to be eventually achieved. However, monitoring

would not be performed to measure changes in the contaminant concentrations, or migration; therefore attainment of ARARs would not be established. Because no action is proposed, location- and action-specific ARARs would not be triggered by this alternative.

6.2.1.3 Long-term Effectiveness and Permanence. This alternative does not provide controls to reduce concentrations of COCs in soil to PRGs. Therefore, the No Action Alternative will not provide long-term effectiveness and permanence for protecting human health from exposure to soil at AOC 57 Area 3.

This alternative also does not provide controls to reduce concentrations of COCs in groundwater to PRGs. However, as discussed in Subsection 6.2.1.2, Compliance with ARARs, groundwater conditions are expected to continue to improve at the site and PRGs will eventually be achieved through diffusion and dispersion processes (and by volatilization and biodegradation processes for organics). However, the effectiveness of these processes would not be monitored, and therefore are not considered during evaluation of this alternative.

6.2.1.4 Reduction of Toxicity, Mobility, or Volume Through Treatment. The No Action Alternative does not employ active removal or treatment processes to address soil or groundwater contamination; therefore, the alternative would not satisfy CERCLA's statutory preference for treatment as a principal component of remedial action.

6.2.1.5 Short-term Effectiveness. This alternative does not provide any remedial actions; therefore, short-term risks to the community or environment would not result from implementation. Soil exposure would not be restricted under this alternative and as a result, the alternative would not provide short-term protection to human health should residential development be permitted in the Area 3 wetland. Groundwater exposure would not be restricted under this alternative. As a result, the alternative would not provide short-term protection to commercial/industrial or residential receptors should water wells be installed in the Area 3 aquifer for potable use.

6.2.1.6 Implementability. Because this alternative does not propose remedial action, there would be no technical or administrative difficulties associated with implementation. Additionally, the No Action Alternative would not limit or interfere with the ability to perform future remedial actions.

6.2.1.7 Cost. There is no cost associated with the No Action Alternative. Because there are no remedial actions considered under this alternative, a sensitivity analysis was not performed.

6.2.2 Alternative III-2: Limited Action

Alternative III-2, Limited Action, is designed to reduce potential human-health risks associated with contaminated soil (wetland) and groundwater (upland and wetland) at the Area 3. This alternative would consist of implementing institutional controls to protect possible future-use (commercial/industrial) and unrestricted-use (residential) receptors. Environmental monitoring would be performed at the site to assess for groundwater COC migration. Five-year site reviews would be performed to ensure that the remedial alternative remains protective of human health and the environment. Alternative III-2 would consist of the following specific components:

- Institutional Controls
  - Land-use restrictions prohibiting residential use of wetland property (soil), and commercial/industrial and residential use of the Area 3 aquifer
- Environmental Monitoring
  - Long-term groundwater monitoring
  - Long-term surface water monitoring
- Institutional Control Inspections
- Five-year Site Reviews

Institutional Controls. As discussed for Area 2, AOC 57 is located within an area designated for "Rail, Industrial, Trade-Related, and Open Recreational" in the Devens Reuse Plan (Vanasse Hangen Brustlin, 1994). Land-use restrictions in the form of zoning or deed restrictions would be imposed to prohibit residential contact with contaminated soil in the wetland, and commercial/industrial and residential well installations in upland and wetland areas. All the land-use restrictions would be stated in full or by reference within zoning ordinances and/or deeds, easements, mortgages, leases or other instrument of property transfer and would be maintained indefinitely. These controls would be drafted, implemented and enforced in cooperation with state and local government.

Environmental Monitoring. Environmental monitoring would consist of performing long-term groundwater and surface water sampling. Long-term groundwater sampling would be performed to assess for groundwater COC (cadmium, 1,4-DCB, arsenic and PCE) migration and to observe for the eventual decrease of the groundwater COCs to concentrations that are protective of commercial/industrial and residential receptors. As discussed in Subsection 6.2.1.2, Compliance with ARARs for Alternative III-1, it is anticipated that because of the removal of approximately 1,860 cy of contaminated soil in 1999, groundwater conditions will continue to improve at the site and groundwater PRGs will be eventually achieved.

Surface water sampling would also be a component of environmental sampling to assess for migration of human-health COCs off-site via the groundwater to surface water pathway. Based on the RI, groundwater in the overburden at Area 3 discharges to Lower Cold Spring Brook and its associated wetlands. However, as determined by the baseline ecological risk

assessment, there are no significant risks associated with Area 3 contaminants to ecological receptors based upon surface soil, sediment and surface water sampling. Furthermore, there does not appear to be a risk to aquatic receptors for the chemicals common to groundwater and surface water. Therefore, the purpose of the surface water sampling would not be to collect additional ecological risk assessment data but rather to provide additional means to confirm that the human-health COCs that exceed PRGs are not migrating off-site via Lower Cold Spring Brook.

Sampling frequency, location, analytes, sampling procedures, and action levels for environmental monitoring would be detailed in a site LTMP and submitted to the regulatory agencies for review prior to implementing the environmental monitoring component of this alternative. As with the Area 2 alternatives, it is assumed that groundwater and surface water sampling for Area 3 would be performed twice per year for the first three years and once per year thereafter. It is also assumed that environmental sampling would be terminated upon obtaining groundwater PRG concentrations for three consecutive sampling events. Costing was based on the assumption that samples would be collected from four existing down-gradient or cross-gradient monitoring wells/piezometers and one existing upgradient monitoring well using low-flow sampling techniques. Surface water samples would be collected from three locations where groundwater discharges from Area 3 and one upgradient location within Lower Cold Spring Brook. Samples would be analyzed for cadmium, 1,4-DCB, arsenic, and PCE. Both filtered and unfiltered samples would be collected for arsenic and cadmium.

<u>Institutional Control Inspections.</u> Regularly scheduled inspections would be performed to confirm that land-use restrictions in the form of deed or zoning restrictions are implemented as required to minimize potential human exposure to soil and groundwater contaminants remaining at the site.

An Institutional Control Monitoring Plan would be prepared and submitted for regulatory agency review as part of the site LTMP to detail the land-use restrictions to be incorporated/referenced in zoning ordinances or within instruments of property transfer. The plan would include a checklist of elements to be assessed during regularly scheduled on-site inspections and interviews with the site property owner, manager or designee. For FFS purposes, it is assumed that elements of the on-site inspection would include verifying that no wells for potable use have been installed on the premises, and there is no evidence of land-use change (i.e., nearby residential construction). Interviews with the site property owner would include reviewing the owner's familiarity with restrictions imposed upon the property, and documentation of these restrictions; and plans for property sale, development for residential use of the site. For FFS costing purposes, it is assumed that the institutional control inspections would be performed once per year. It is also assumed that institutional control inspections and environmental sampling might be performed by different entities and therefore separate site trips were costed.

Five-Year Site Reviews. Under CERCLA 121c, any remedial action that results in contaminants remaining on-site must be reviewed at least once every five years. During five-year site reviews, an assessment is made of whether the implemented remedy continues to be protective of human health and the environment or whether the implementation of additional remedial action is appropriate. The five-year site review component described in Subsection 6.1.2 for Area 2, Alternative II-2 also applies to Area 3.

6.2.2.1 Overall Protection of Human Health and the Environment. The human-health risk assessment identified risks in excess of USEPA's Superfund risk range and target HI from exposure to surface soils and groundwater only for possible future land use and unrestricted land use scenarios, and not for current land use.

The EPH C11-C22 aromatic carbon range exceeds unrestricted-use risk-based PRGs in wetland soils at Area 3. A zoning or deed restriction would be imposed at Area 3 wetlands to prohibit residential development. A residential deed or zoning restriction would minimize residential exposure to COCs at concentrations exceeding unrestricted-use PRGs.

Arsenic, cadmium, and 1,4-DCB in upland groundwater exceed ARAR-based PRGs and arsenic and PCE in wetland groundwater exceed ARAR-based PRGs. The zoning or deed restriction that prohibits residential development (to minimize soil exposure) would also include a restriction preventing installation of potable wells in the upland and wetland areas. Therefore, Alternative III-2 will provide protection to human health. The ecological risk assessment did not identify unacceptable risks to the environment.

6.2.2.2 Compliance with ARARs. Alternative III-2 does not include actions that would actively reduce contaminant concentrations in site soils or groundwater, but does include controls to reduce the potential for human receptor exposure to contaminant concentrations, and environmental monitoring to confirm that groundwater ARARs are eventually achieved.

Chemical-specific ARARs. Chemical-specific ARARs triggered by Alternative III-2 are presented in Table 6-16. The same discussions pertaining to chemical-specific ARARs, the 1999 soil removal action and resultant improvement of groundwater conditions in Subsection 6.2.1.2 (Compliance with ARARs for the No Action Alternative) apply to Alternative III-2. Unlike the No Action Alternative, monitoring would be performed for Alternative III-2 to measure changes in contaminant concentrations or migration; therefore attainment of groundwater ARARs would eventually be confirmed at the two locations (57M-96-11X and 57M-95-03X), where MCL/MMCL exceedances have been detected.

Location-specific ARARs. No location-specific ARARs would be triggered by this alternative.

Action-specific ARARs. As listed in Table 6-18, IDW produced from groundwater sampling would be managed in accordance with USEPA OSWER Publication 9345.3-03FS which is considered To be Considered Information.

6.2.2.3 Long-term Effectiveness and Permanence. Alternative III-2 provides institutional controls to restrict groundwater use and human receptor exposure to soils containing COCs that exceed PRGs. Long-term maintenance of these controls would be essential for long-term effectiveness.

This alternative does not provide active controls to reduce concentrations of COCs in soil or groundwater to PRGs at Area 3 uplands/wetlands. However, as discussed in Subsection 6.2.1.2, Compliance with ARARs (No Action), groundwater conditions are expected to continue to improve at the site as a result of the 1999 soil removal action at the source area. PRGs (currently exceeded in only two groundwater monitoring wells) will eventually be achieved through diffusion and dispersion processes (arsenic, PCE cadmium, 1,4-DCB) and to a limited extent, volatilization and biodegradation processes (PCE, 1,4-DCB). Long-term environmental monitoring would assess the effectiveness and permanence of these processes in groundwater.

6.2.2.4 Reduction of Toxicity, Mobility, or Volume Through Treatment. Alternative III-2 does not employ active removal or treatment processes to address soil contamination; therefore, the alternative would not satisfy CERCLA's statutory preference for treatment as a principal component of remedial action. For reduction of toxicity and volume of groundwater COCs, this alternative relies principally on the natural processes of diffusion and dispersion following the former soil removal action to regain upgradient water quality (i.e., ORP) conditions and to reduce residual COC concentrations in groundwater. Regaining upgradient groundwater conditions will decrease the solubility of naturally occurring arsenic, the major risk contributor in groundwater at the site.

6.2.2.5 Short-term Effectiveness. Actions associated with Alternative III-2 include applying land-use restrictions and performing long-term environmental monitoring. When routinely implemented and checked, these actions protect site workers and the community until PRGs are achieved. Because this alternative does not provide active or intrusive remedial actions, this alternative would not pose a significant risk to the community, site workers, or the environment during implementation. A site-specific HASP would minimize risks to site workers and adverse effects to the environment during groundwater and surface water sampling.

An approved Institutional Control Monitoring Plan and deed restrictions could be developed and implemented to achieve RAOs within approximately two to six months upon signing of the ROD. It is assumed that residential land-use restrictions pertaining to

soil exposure would be imposed indefinitely. Environmental sampling and land-use restrictions pertaining to groundwater exposure would be imposed until groundwater PRGs are achieved. An estimate pertaining to groundwater cleanup duration is discussed in greater detail in Subsection 6.2.2.7 Cost.

6.2.2.6 Implementability. Because of the nature of remedial actions for this alternative, no adverse implementation issues are anticipated. Institutional controls should be easily implemented considering that AOC 57 is slated for commercial/industrial use and recreation/open space. Environmental sampling and analysis are well demonstrated and readily available. Long-term monitoring and maintenance of institutional controls would be required to ensure effectiveness of this alternative. Alternative III-2 would not limit or interfere with the ability to perform future remedial actions.

6.2.2.7 Cost. Table 6-25 presents a summary of the estimated costs to implement Alternative III-2. The total NPW cost of the alternative is estimated to be $298,000. Over 90 percent of this cost is related to long-term environmental monitoring and maintenance of institutional controls. Costs were developed assuming that land-use restrictions pertaining to soil exposure would be imposed indefinitely. As explained earlier in Section 6.0, a 30-year NPW cost is presented for alternatives with an indefinite implementation or cleanup period. There is also uncertainty pertaining to the duration that long-term environmental monitoring and groundwater-use deed restrictions would need to be imposed. These components would be required until groundwater PRGs are achieved. As with Area 2, this duration is principally dictated by the time required for subsidence of reducing conditions that are enhancing the solubility of naturally occurring arsenic. As previously discussed, the reducing conditions are created by the biodegradation of petroleum compounds at Area 3, which has likely been lessened as a result of the 1999 soil removal action. Given these uncertainties, a baseline cost was developed based on the conservative assumption that reducing conditions will persist for 30 years or greater for a comparison with the other alternatives. The effects of a reduced cleanup period was then evaluated as part of a cost sensitivity analysis and is discussed later within this subsection. A more refined estimate of cleanup duration may be possible upon collection of long-term groundwater monitoring data.

The following assumptions were used in estimating the baseline cost:

- There will be minimal difficulty in implementing zoning and/or deed restrictions.
- Institutional control inspections will be performed once per year.
- Environmental sampling will be performed twice per year for the first three years and once per year thereafter. Environmental sampling will be terminated upon obtaining groundwater PRG concentrations for three consecutive sampling events.
- Groundwater samples will be collected at five existing monitoring wells using low-flow sampling techniques.
- Surface water samples will be collected from four locations in Cold Spring Brook.
- Groundwater and surface water samples will be analyzed for arsenic, cadmium, PCE

and 1,4-DCB (USEPA Methods 6010 for inorganics, 8260 for PCE, and 8270 for 1,4-DCB). Both filtered and unfiltered samples will be collected for arsenic and cadmium.
- QC samples will be collected at a frequency of one per ten regular samples (ten percent).

Cost-sensitivity Analysis. A cost-sensitivity analysis was performed to assess the effect of specific assumptions on the estimated cost of Alternative III-2. As with the alternatives evaluated for Area 2, the greatest uncertainty in the cost estimate pertains to the duration that long-term environmental monitoring and groundwater-use deed restrictions would need to be imposed. These components would be required until groundwater PRGs are achieved. Because of the uncertainty of this duration, costs for this alternative were evaluated for two extreme but possible environmental monitoring durations (7 years and the baseline of 30 years). The minimum duration of 7 years was based on the assumption that the former removal action was completely successful at removing enough of the source that created the reducing conditions at the site. The minimum time for the groundwater to return to aerobic conditions is estimated as the time to flush out the pore volume of groundwater associated with the identified area of contamination. To be conservative, the calculation assumes that two pore volumes of flushing would be required. Two flushes would require 1 to 8 years at Area 3. The assumptions and calculations that serve as the basis for the flush time are provided in Appendix C. Given that the removal action occurred in 1999, background concentrations would be achieved after 5 years (average of 1 and 8 years) after 2004. Therefore for the low range cost-sensitivity scenario, 7 years of sampling would be required, assuming groundwater sampling would commence in 2001 and that sampling would be terminated upon obtaining groundwater PRG concentrations for three consecutive sampling events. As shown in Table 6-25, a reduction in sampling duration decreases the overall cost for Alternative III-2 by approximately 49 percent ($298,000 down to $200,000).

Various other factors could have minor impacts on the cost of Alternative III-2. These include the number of monitoring wells and surface water samples to be collected, and the sampling frequency for environmental monitoring. These factors were considered but not included in the sensitivity analysis due to the lesser effect when compared to the variation in duration and the fact that the same factors (e.g., number of sampled locations, sample frequency) would be applied to each of the alternatives. The details of the LTMP will be completed following finalization of the FFS, selection of the preferred alternative and upon signing of the ROD. This FFS provides only an assumed long-term monitoring scope to facilitate evaluation of costs.

6.2.3 Alternative III-3: Excavation (For Unrestricted Use) And Institutional Controls

Alternative III-3, is designed to reduce potential human-health risks associated with contaminated soil and groundwater at the Area 3 upland and wetland. This alternative

would consist of excavating contaminated soils to protect unrestricted-use (residential) receptors from soil exposure and implementing institutional controls to protect possible future-use (commercial/industrial) and unrestricted-use (residential) receptors from groundwater exposures. Environmental monitoring would be performed at the site to assess for groundwater COC migration. Five-year site reviews would be performed to ensure that the remedial alternative remains protective of human health and the environment. Alternative III-3 would consist of the following specific components:

- Wetlands Protection
- Soil Excavation and Treatment/Disposal at an Off-Site TSD Facility
- Institutional Controls
  - Land-use restrictions prohibiting commercial/industrial and residential potable use of the Area 3 aquifer
- Environmental Monitoring:
  - Long-term groundwater monitoring
  - Long-term surface water monitoring
- Institutional Control Inspections
- Five-year Site Reviews

Wetlands Protection. Wetland protection would likely be required as a result of potential wetland impacts from excavation activities. Protection would be in accordance with the Massachusetts Wetland Protection Act and Regulations, specifically 310 CMR 10.55. Construction work would be within the 100-year flood plain (228 feet msl) and would probably be within the delineated bordering vegetated wetland based on a 1993 wetlands delineation performed for Area 2. As a precursor to remedial activities, the wetlands at Area 3 would be delineated. If the proposed construction area is confirmed to be within delineated vegetated wetlands, a pre-construction mitigation study would be performed to determine the impact to the affected area and the compensatory mitigation required as a result of the excavation activities. Once the extent of anticipated impacts is known, a mitigation plan would be prepared for agency review and approval. Discussion in Subsection 6.1.3 pertaining to wetland protection, restoration and monitoring, for Alternative II-3 for Area 2, also applies to Alternative III-3 at Area 3.

Soil Excavation and Treatment/Disposal at an Off-Site TSD. Alternative III-3 would entail excavating wetland soils that exceed residential-use PRGs. Area and depth of the excavation would include soils with EPH C11-C22 aromatic carbon range concentrations in excess of its PRG that is considered protective of residential exposure. The in-place volume of soil to be excavated is estimated to be approximately 120 cy. The estimated areal extent of soil contamination to be excavated is shown in Figure 3-5 based on observed PRG exceedances. Based upon the Removal Action findings, it is assumed that for cost estimating purposes the average depth of the residual contaminated soil would extend down to approximately 3 feet bgs.

Prior to excavation, a soil berm, siltation fence and/or hay bales will be positioned

downgradient of the proposed excavation area to minimize migration of contaminated soils and siltation of Cold Spring Brook wetland. A temporary stockpile area would be constructed for dewatering of saturated soils and stockpiling for soil characterization. For cost estimating purposes, it is assumed that the stockpile area would be an approximate 50 feet by 50 feet bermed area constructed with an impervious liner. It is also assumed that the stockpile area would be located at the former fenced area approximately 50 feet north of Area 3. Precipitation and/or supernatant water from saturated soil stockpiles would be pumped from low points of the containment area into frac tanks and sampled. At a minimum, sampling would be in accordance with the Sewer Use Rules and Regulations for the Devens Sewerage Service Area (MassDevelopment, 1998) as discussed in Subsection 6.1.3 for Alternative II-3 for Area 2. Excavation activities discussed in Subsection 6.1.3 also apply to Alternative III-3, except that for FFS costing purposes, it is assumed that the extent of excavation would be guided using a portable UVF for on-site field screening for the EPH C11-C22 carbon range. Confirmation samples would be submitted off-site for EPH analysis by the MADEP EPH Method), Groundwater encountered in the excavation will be removed by creating a sump in a corner of the excavation. This remediation wastewater will be pumped from the excavation and into a temporary on-site frac tank and sampled for disposal options. Refer to Subsection 6.2.3.7 for additional assumptions used in preparing the cost for Alternative III-3.

<u>Institutional Controls.</u> Institutional controls in the form of land-use restrictions would limit commercial/industrial and residential use of the aquifer at Area 3. Unlike, Alternative III-2, deed restrictions pertaining to residential exposure to soils at the Area 3 wetland would not be required for Alternative III-3 because the soil excavation component would remove the EPH C11-C22 carbon range concentrations that exceed the unrestricted-use PRG. However, land-use restrictions, as described for Alternative III-2 (Subsection 6.2.2), in the form of zoning or deed restrictions would still be imposed to prohibit well installation for potable use in the upland and wetland aquifer.

<u>Environmental Monitoring.</u> Environmental monitoring would consist of performing long-term groundwater and surface water sampling as described for Alternative III-2 (Subsection 6.2.2).

<u>Institutional Control Inspections.</u> Regularly scheduled inspections would be performed to confirm that land-use restrictions in the form of deed or zoning restrictions are implemented to minimize potential human exposure to soil and groundwater COCs remaining at the site. An Institutional Control Monitoring Plan would be prepared and inspections performed as described for Alternative III-2 (Subsection 6.2.2) except that the inspection/interview elements pertaining to residential exposure to soil within the Area 3 wetland would not apply. Because the soil excavation component of Alternative III-3 would remove COCs that exceed the unrestricted-use PRG, deed restrictions and subsequent inspections/interviews pertaining to residential exposure to soil at the Area 3 wetland would

not be required.

Five-Year Site Reviews. Five-year site reviews would be performed as described for Alternative II-2 (Subsection 6.1.2).

6.2.3.1 Overall Protection of Human Health and the Environment. The human-health risk assessment identified risks in excess of USEPA's Superfund risk range and target HI from exposure to surface soils and groundwater only for possible future land use and unrestricted land use scenarios, and not for current land use.

The EPH C11-C22 carbon range concentrations in wetland soil exceed its unrestricted-use risk-based PRG. Soil with C11-C22 concentrations exceeding this PRG would be excavated and treated/disposed off-site, thus minimizing risk to the residential receptor.

Arsenic, cadmium and 1,4-DCB in upland groundwater and arsenic and PCE in wetland groundwater exceed ARAR-based PRGs. A zoning or deed restriction that prohibits installation of water wells in upland and wetland areas would be imposed to minimize exposure to groundwater. Therefore, Alternative III-3 will provide protection to human health. The ecological risk assessment did not identify unacceptable risks to the environment.

6.2.3.2 Compliance with ARARs. Alternative III-3 includes actions that would actively reduce contaminant concentrations in site soils, but not groundwater. The alternative does include controls to reduce the potential for human receptor exposure to contaminant concentrations in groundwater, and environmental monitoring to confirm that groundwater ARARs are eventually achieved.

Chemical-specific ARARs. Chemical-specific ARARs triggered by Alternative III-3 are presented in Table 6-19. The same discussions pertaining to chemical-specific ARARs, the 1999 soil removal action and resultant improvement of groundwater conditions in Subsection 6.2.1.2 (Compliance with ARARs for the No Action Alternative) apply to Alternative III-3. In addition, the proposed excavation of soils as a component of Alternative III-3 is likely to expedite improvements to groundwater conditions. However these improvements are not readily quantifiable until long-term monitoring is initiated. Monitoring would be performed to measure changes in contaminant concentrations or migration; therefore attainment of groundwater ARARs would eventually be confirmed at the two locations (57M-95-03X and 57M-96-11X), where MCL/MMCL exceedances have been detected.

Location- and Action-Specific ARARs. Location- and action-specific ARARs triggered by Alternative III-3 are presented in Tables 6-20 and 6-21, respectively. Discussions pertaining to location- and action-specific ARARs in Subsection 6.1.3.2 for Alternative II-3 also apply to Alternative III-3.

6.2.3.3 Long-term Effectiveness and Permanence. Removal of soils containing COCs that exceed unrestricted-use PRGs would effectively and permanently minimize risk to the residential receptor.

This alternative does not provide active controls to reduce concentrations of COCs in groundwater at Area 3 uplands and wetlands. However, as discussed in Subsection 6.2.1.2, Compliance with ARARs (No Action), groundwater conditions are expected to continue to improve at the site as a result of the 1999 soil removal action at the source area. PRGs (currently exceeded in only two groundwater monitoring wells) will eventually be achieved through diffusion and dispersion processes and to a more limited extent for organic COCs by volatilization and biodegradation processes. Long-term environmental monitoring would assess the effectiveness and permanence of these processes in groundwater. Until groundwater PRGs are achieved, Alternative III-3 provides institutional controls to restrict commercial/industrial and residential exposure to groundwater containing COCs that exceed PRGs.

6.2.3.4 Reduction of Toxicity, Mobility, or Volume Through Treatment. Alternative III-3 employs active removal processes and off-site treatment/disposal at a licensed TSD facility to address soil contamination; therefore, the alternative would satisfy CERCLA's statutory preference for treatment as a principal component of remedial action. For reduction of toxicity and volume of groundwater COCs, this alternative relies principally on the natural processes of diffusion and dispersion following the former soil removal action to regain upgradient water quality (i.e., ORP) conditions and for reduction in COC concentration. Regaining upgradient groundwater conditions will decrease the solubility of naturally occurring arsenic, the major risk contributor in groundwater at the site.

6.2.3.5 Short-term Effectiveness. Actions associated with Alternative III-3 include soil excavation and transportation, applying land-use restrictions and performing long-term environmental monitoring.

Short-term risks to the community from excavation activities would be minimal during implementation of this alternative because there are no residences near AOC 57. Risks to workers would be primarily from incidental ingestion of soils and dermal contact. Personal protective equipment would be required to minimize risk to workers during excavation. Engineering controls to limit dust generation would also be implemented to minimize exposure to downwind receptors. Soils would be transported to the TSD facility following federal and state regulations. The soil excavation is expected to take approximately 1 week to complete.

A site-specific HASP would minimize risks to site workers and adverse effects to the environment during groundwater and surface water sampling. An approved Institutional Control Monitoring Plan and deed restrictions could be developed and implemented to achieve RAOs within approximately two to six months upon signing of the ROD.

Environmental sampling and land-use restrictions pertaining to groundwater exposure would be imposed until groundwater PRGs are achieved. An estimate pertaining to groundwater cleanup duration is discussed in greater detail in Paragraph 6.1.3.7 Cost.

6.2.3.6 Implementability. Excavation at Area 3 wetlands is readily implementable using standard construction practices. Excavation may extend to or slightly below the water table so that dewatering may be necessary. Wetland protection and restoration will also likely be required due to wetlands disturbance from soil removal activities. Federal, state, and licensing requirements of the TSD will govern off-site soil transportation, treatment and disposal. Institutional controls prohibiting potable use of the aquifer should be easily implemented considering that the AOC 57 is slated for commercial/industrial use and recreation/open space. A municipal potable water supply system is also available at Devens. The technology of environmental sampling and analysis are well demonstrated and readily available. Long-term monitoring and maintenance of institutional controls would be required to ensure effectiveness of this alternative. Alternative III-3 would not limit or interfere with the ability to perform future remedial actions.

6.2.3.7 Cost. Table 6-26 presents a summary of the estimated costs to implement Alternative III-3. The total NPW cost of the alternative is estimated to be $387,000. Approximately 20 percent of this cost is related to the capital cost associated with excavation. As explained earlier in Section 6.0, a 30-year NPW cost is presented for alternatives with an indefinite implementation or cleanup period. As discussed in Subsection 6.2.2.7, Cost for Alternative III-2, there is considerable uncertainty pertaining to the duration that long-term environmental monitoring, groundwater-use deed restrictions/inspections and 5-year site reviews would need to be implemented. Unlike Alternative III-2, institutional controls and 5-year site reviews would not be required once environmental monitoring verify that MCLs/MMCLs have been achieved. A baseline cost was developed for Alternative III-3 based on the conservative assumption that reducing conditions will persist for 30 years or greater for a comparison with the other alternatives. The effects of a reduced cleanup period was then evaluated as part of a cost sensitivity analysis and is discussed later within this subsection.

The following assumptions were used in estimating the baseline cost:

- Approximately 120 cy (216 tons) of soil will be excavated.
- Soil may all be disposed as MA99 waste under a MADEP BOL (i.e., no hazardous waste).
- The lined stockpile/dewatering area will be approximately 50 feet by 50 feet.
- Water in the excavation and leachate from the stockpiles will be collected and treated off-site.
- The extent of excavation will be guided by field screening methods, specifically USEPA Method 4035 immuno-assay testing for EPH C11-C22 carbon range.
- Approximately 10 confirmation samples will be collected (one sample per 900 sq. ft of floor area and one sample per 30 feet of wall length) and analyzed off-site.

- Off-site soil analytical costs are based on 3-day turn-around-time and analysis by the EPH MADEP Method.
- There will be minimal difficulty in implementing zoning and/or deed restrictions.
- Institutional control inspections will be performed once per year.
- Environmental sampling will be performed twice per year for the first three years and once per year thereafter. Environmental sampling will be terminated upon obtaining groundwater PRG concentrations for three consecutive sampling events.
- Groundwater samples will be collected at five existing monitoring wells using low-flow sampling techniques.
- Surface water samples will be collected from four locations in Cold Spring Brook.
- Groundwater and surface water samples will be analyzed for cadmium, 1,4-DCB, arsenic and PCE. Both filtered and unfiltered samples would be collected for arsenic and cadmium.
- QC samples will be collected at a frequency of one per ten regular samples (ten percent).

Cost-sensitivity Analysis. A cost-sensitivity analysis was performed to assess the effect of specific assumptions on the estimated cost of Alternative III-3. As with Alternative III-2, the greatest uncertainty in the cost estimate pertains to the duration that long-term environmental monitoring, groundwater-use deed restrictions/inspections and 5-year would need to be imposed. Costs for this alternative were evaluated for a range in duration (7 and 30 years). Refer to the cost sensitivity discussion in paragraph 6.2.2.7 and Appendix C, regarding monitoring duration derivation.

An uncertainty in the capital cost estimate pertains to the volume of soil that will require excavation to achieve unrestricted-use PRGs, specifically in regard to depth. If the average depth of excavation of the area shown in Figure 3-5 varies by +/-1 foot, the total volume excavated will change by +/- 33 percent changing soil/excavation, transportation and TSD costs, proportionally.

Decreasing the environmental sampling and institutional control inspection durations to 7 years, and 5-year site reviews to two 5-year review periods, decreases the total O&M present worth cost by approximately 45 percent. Varying the quantity of soil excavated by +/- 33 percent, changes the total capital cost by approximately 8 percent. The low range costs (33 percent less soil excavated and 7 years of environmental monitoring, institutional controls and 5-year site reviews) and high range costs (25 percent greater soil excavated and 30 years of environmental monitoring, institutional controls, and 5-year site reviews) are presented in Table 6-26. Low-range and high-range costs ($252,000 and $395,000) varied from the baseline present worth cost by approximately 35 percent and 2 percent, respectively.

Refer to the cost sensitivity discussion for Alternative III-2 in Subsection 6.2.2.7, pertaining to other factors could also have minor impacts on the cost of Alternative III-3.

These factors were considered but not included in the sensitivity analysis due to the lesser effect.

7.0 COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVES

The comparative analysis compares the alternatives for each area with respect to the evaluation criteria used during the detailed analysis of alternatives. The purposes of the comparative analysis are to identify the advantages and disadvantages of alternatives relative to one another, and to aid in the eventual selection of a remedial alternative for each area. The preferred alternatives will be identified in the Proposed Plan for AOC 57. The evaluation criteria are divided into three specific categories during remedy selection: Threshold Criteria, Primary Balancing Criteria, and Modifying Criteria. Subsection 7.1 presents the approach of the comparative analysis based on the NCP with respect to these three categories; Subsection 7.2 presents the comparison of alternatives for Area 2 wetland at AOC 57; and Subsection 7.3 presents the comparison of alternatives for Area 3 upland and wetland at AOC 57.

7.1 APPROACH TO THE COMPARATIVE ANALYSIS

The NCP outlines the approach for performing the comparative analysis of site alternatives. The remedy proposed must reflect the scope and purpose of the actions being undertaken and how these actions relate to other remedial actions and the long-term response at the site. Identification of the preferred alternative and final remedy selection are based on an evaluation of the major tradeoffs among alternatives in terms of the nine evaluation criteria. USEPA categorizes the evaluation criteria into three groups: threshold, balancing, and modifying. Each criteria group is discussed in the following subsections.

7.1.1 Threshold Criteria

USEPA designated (1) overall protection of human health and the environment, and (2) compliance with ARARs as the two threshold criteria. An alternative must meet both criteria to be eligible for selection as the preferred site remedy.

7.1.2 Primary Balancing Criteria

The five primary balancing criteria are long-term effectiveness and permanence; reduction of toxicity, mobility, or volume through treatment; short-term effectiveness; implementability; and cost. These balancing criteria provide a preliminary assessment of the extent to which permanent solutions and treatment can be used practicably and in a cost-effective manner.

An alternative that is protective of human health and the environment, is ARAR-compliant, and affords the best balance among these criteria is identified as the preferred

alternative in the Proposed Plan. The balancing emphasizes long-term effectiveness and reduction of toxicity, mobility, or volume through treatment.

7.1.3 Modifying Criteria

State and community acceptance is factored into a final balancing that determines the preferred remedy and the extent of permanent solutions and treatment practicable for the site. Formal state-regulatory-agency comments will not be received until after the agencies have reviewed the FS report. Community concerns will be factored into the FS process following the public comment period on the Proposed Plan.

7.2 COMPARATIVE ANALYSIS OF ALTERNATIVES FOR AREA 2 WETLAND

Comparative analyses of alternatives for the Area 2 wetland at AOC 57 are presented in the following subsections and summarized in Table 7-1. The four remedial alternatives that are the focus of the comparative analysis are:

- Alternative II-1: No Action
- Alternative II-2: Limited Action
- Alternative II-3: Excavation (for Possible Future Use) and Institutional Controls
- Alternative II-4: Excavation (for Unrestricted Use) and Institutional Controls

7.2.1 Overall Protection of Human Health and the Environment

This criterion, according to CERCLA, must be met for a remedial alternative to be chosen as a final site remedy. At AOC 57 Area 2 wetland, the human-health risk assessment identified risks in excess of USEPA's Superfund risk range and target HI from exposure to surface and subsurface soils and groundwater. Aroclor-1260, lead, arsenic, chromium, and EPH C11-C22 aromatic carbon range concentrations exceed risk-based PRGs in soils. Arsenic and PCE exceed MCL/MMCL-based PRGs in groundwater. These soil and groundwater risk exceedances are based only upon possible future-use (construction worker exposure to soil) and unrestricted-use (residential exposure to soil and groundwater) scenarios. The risk assessment for assumed current site use (maintenance worker and recreational child) revealed that human-health risk was within the USEPA's Superfund risk range and below the target HI. Land use is slated for commercial/industrial and recreation/open space and not residential. Furthermore residential use of wetland areas is highly improbable. Potable use of AOC 57 groundwater is not expected, since Devens is supplied with municipal water; however, risk assessments for commercial/industrial and residential groundwater use were still performed for risk management considerations. Arsenic, which contributes greater than 90 percent to the carcinogenic risk from ingestion of groundwater at the site (Table3-2), is believed to be naturally occurring but currently elevated from reducing conditions caused

by biodegradation of organic site contaminants. The ecological risk assessment did not identify unacceptable risks to ecological receptors from exposure to sediments or surface water.

Alternative II-1 was developed as a baseline with which to compare the other alternatives and proposes no action and, although protective of the environment, would not provide protection to human health. Alternatives II-2, II-3 and II-4 are all protective of human health and the environment. These alternatives all utilize institutional controls and environmental monitoring to protect the unrestricted-use receptor from exposure to contaminated groundwater at the site, but each provides a different means for protection from exposure to contaminated soil. Alternative II-2 utilizes institutional controls to restrict exposure to soil at the site. Deed restrictions would limit invasive activities within Area 2 wetland soil for protection of the possible future-use receptor. Zoning or deed restriction would also prohibit residential development of the Area 2-wetland property for protection of the unrestricted-use receptor. Alternative II-3 utilizes soil excavation and off-site treatment/disposal to protect the future-use receptor from exposure to soil but uses zoning or deed restriction to protect the unrestricted-use receptor from exposure to soil. Alternative II-3 utilizes soil excavation and off-site treatment/disposal to protect both the future-use and unrestricted-use receptor from exposure to soil.

7.2.2 Compliance with ARARs

CERCLA requires that the selected alternatives also meet a second threshold criterion of compliance with ARARs, or obtain a waiver if the criterion can not be met. This criterion, according to CERCLA, must be met for a remedial alternative to be chosen as a final site remedy.

Chemical-Specific ARARs. Groundwater COCs that exceed chemical-specific ARARs (e.g., MCLs, MMCLs and the Massachusetts Groundwater Quality Criteria [314 CMR 6.00]) are arsenic and PCE. Chemical-specific ARARs would not be met by any of the alternatives in the short-term, but would be met by natural attenuation processes in the long-term. All the alternatives rely on the benefits of the former soil removal action and groundwater diffusion and dispersion to meet chemical-specific ARARs within the two monitoring wells where ARARs are marginally or sporadically exceeded. Alternatives II-2, II-3 and II-4 would use environmental monitoring to evaluate long-term effectiveness and the potential for COC migration off-site. Alternative II-1 would not implement environmental monitoring to measure changes in the contaminant concentrations, or migration; therefore attainment of ARARs would not be established.

Soil PRGs were not established using promulgated guidance values and therefore are not considered ARARs for any of the alternatives.

Action-Specific ARARs. Alternatives II-3 and II-4 would need to meet action-specific

ARARs because of the soil excavation component. Federal and state regulations pertaining to the handling, transportation, and disposal of solid and hazardous wastes would be triggered because of the soil removal activities performed as a component of Alternative II-3. Construction activities would also be controlled to meet federal and state regulations pertaining to the control of surface water runoff, and protection of surface water and air quality. Alternative II-2, which entails only implementing institutional controls and monitoring, would not trigger these ARARs.

Location-Specific ARARs. Alternatives II-3 and II-4 would need to meet federal and state regulations pertaining to the protection of wetland and floodplain areas because of the soil removal activities that would be performed in the vicinity of Lower Cold Spring Brook. Protection of endangered species may also need to be considered during the design and implementation of both these alternatives. Alternative II-2, which entails only implementing institutional controls and monitoring, would not trigger these ARARs.

7.2.3 Long-Term Effectiveness and Permanence

This criterion evaluates the magnitude of residual risk and the reliability of controls after response objectives have been met. Alternative II-1 does not provide long-term effectiveness and permanence for protecting human health from exposure to soil at Area 2 wetlands. Alternative II-2 relies on institutional controls to restrict human receptor exposure to soils containing COCs that exceed PRGs. Long-term maintenance of these controls would be essential to ensure long-term effectiveness. Alternatives II-3 and II-4 entail different degrees of soil excavation to effectively and permanently minimize risk to human receptors. The excavation component in Alternative II-3 removes COCs that exceed possible future-use PRGs and would effectively and permanently minimize risk to the construction worker receptor. However, because COCs that exceed unrestricted-use PRGs would remain on-site, Alternative II-3 requires institutional controls to restrict residential exposure. These controls would be relatively easy to maintain to ensure long-term effectiveness given that the property is adjacent to and within a wetland area and is slated for open/recreational use. The excavation component in Alternative II-4 removes COCs that exceed unrestricted-use PRGs and would effectively and permanently minimize risk to the construction worker and residential receptors from exposure to contaminated soils, without the use of institutional controls. Overall, the degree of permanence increases for each Alternative (i.e., Alternative II-1<Alternative II-2<Alternative II-3<Alterantive II-4) because of the decreasing need to depend on institutional control enforcement for long-term effectiveness.

None of the alternatives provide active controls to reduce concentrations of COCs in groundwater at Area 2 wetlands. However, groundwater conditions are expected to continue to improve at the site as a result of the former soil removal action at the source area. PRGs (currently exceeded in only two groundwater monitoring wells) will eventually be achieved through diffusion and dispersion processes (arsenic and PCE) and

to a limited extent by volatilization and biodegradation processes (PCE). Alternatives II-2, II-3 and II-4 provide long-term environmental monitoring to assess the effectiveness and permanence of these processes in groundwater. Until groundwater PRGs are achieved, Alternative II-2, II-3 and II-4 provide institutional controls to restrict potable use of groundwater containing COCs that exceed PRGs. Alternative II-1 utilizes the same natural groundwater processes as the other alternatives but provides no means for monitoring to assess the effectiveness and permanence of these natural processes. It also does not provide institutional controls to restrict potable use of groundwater during the period when groundwater PRGs are exceeded.

7.2.4 Reduction of Toxicity, Mobility, or Volume Through Treatment

This criterion evaluates whether the alternatives meet the statutory preference for treatment under CERCLA. The criterion evaluates the reduction of toxicity, mobility, or volume of contaminants, and the type and quantity of treatment residuals.

Alternatives II-1 and II-2 do not employ active removal or treatment processes to address soil contamination and therefore would not satisfy CERCLA's statutory preference for treatment as a principal component for soil remedial action. Alternatives II-3 and II-4 both employ active removal processes and off-site treatment/disposal at a licensed TSD facility to address soil contamination and therefore satisfy CERCLA's statutory preference for treatment. Alternative II-3 would leave residual COCs exceeding unrestricted-use PRGs in Area 2 wetland soils, whereas Alternative II-4 would remove COCs that exceed unrestricted-use PRGs. Therefore, Alternative II-4 provides the greatest degree of reduction of toxicity, mobility, and volume through treatment.

For reduction of toxicity and volume of groundwater COCs, all alternatives rely principally on the natural processes of diffusion and dispersion following the former soil removal action to regain upgradient water quality (i.e., ORP) conditions. Regaining upgradient groundwater conditions will decrease the solubility of naturally occurring arsenic, the major risk contributor in groundwater at the site.

7.2.5 Short-Term Effectiveness

CERCLA requires that potential adverse short-term effects to workers, the surrounding community, and the environment be considered during selection of a remedial action. Alternative II-2 provides the least adverse short-term effects of all the alternatives. Alternative II-2 includes applying land-use restrictions to minimize human exposure to site soils. Because this alternative does not provide active or intrusive remedial actions, this alternative would not pose a significant risk to the community, site workers, or the environment during implementation. Alternative II-1 does not provide any remedial actions; therefore, short-term risks to the community or environment would not result from

implementation. However, soil exposure would not be restricted under this alternative, and therefore, would not provide any short-term protection should construction work or residential development be permitted in the Area 2 wetland. Alternatives II-3 and II-4 both include excavation of site soils as a component, which increases the potential risks to remedial workers. Personal protective equipment and engineering controls (dust control) would be required to minimize risk to workers and exposure to downwind receptors. Soils would be transported to the TSD facility following federal and state regulations. Alternative II-4 has the greatest short-term impacts as the wetlands due to the larger area that will require excavation, (Figure 3-3 for Alternative II-4 versus Figures 3-1 for Alternative II-3).

All alternatives, except Alternative II-1, include applying land-use restrictions prohibiting groundwater use and performing long-term environmental monitoring. When routinely implemented and checked these actions protect site workers and the community until PRGs in groundwater are achieved. Qualitatively, it is possible that groundwater PRGs may be achieved the earliest with Alternative II-4, given that this alternative includes removal of the greatest volume of soil.

7.2.6 Implementability

This criterion evaluates each alternative's ease of construction and operation, and availability of services, equipment, and materials to construct and operate the alternative. Also evaluated is the ease of undertaking additional remedial actions and administrative feasibility.

Although the engineering/implementation complexity increases for each alternative, (i.e., Alternative II-4 > Alternative II-3 > Alternative II-2 > Alternative II-1), engineering and construction services, equipment, and materials are readily available to implement any of the alternatives. Alternative II-1 requires no remedial action. Alternative II-2 requires only the implementation of institutional controls, which should be readily enforceable given Area 2's location with respect to wetlands. Alternatives II-3 and -4 are each incrementally greater in complexity and wetland disruption due to additional soil excavation.

None of the alternatives would limit or interfere with the ability to perform future remedial actions.

7.2.7 Cost

There are no costs associated with Alternative II-1. Capital, O&M, and present worth costs were estimated for Alternatives II-2 through II-4. Cost estimates for these alternatives included similar expense for long-term environmental monitoring. As would be expected, Alternatives II-2 and II-4 are the least and most expensive alternatives at

$244,000 and $1,321,000, respectively. Alternative II-3 is the mid-range alternative at $667,000.

Comparison of the NPW costs over 30 years reveals that the benefit of achieving possible future-use PRGs in soil (difference between Alternatives II-2 and II-3), costs approximately $423,000 while the benefit of achieving unrestricted use PRGs in soil (difference between Alternatives II-2 and Alternative II-4) costs approximately $1,077,000.

Achieving groundwater PRGs within 3 years (i.e., eliminating the need for institutional control inspections and 5-year site reviews in Alternative II-4 after 3 years) has minimal effect on the NPW cost. The expense of achieving unrestricted use PRGs in soil (difference between low range NPW costs for Alternatives II-2 and II-4) is approximately $1,030,000 if it is assumed that environmental sampling, institutional control inspections and 5-year site reviews are not required after 3 years. (Note for this comparison, the capital cost decrease of approximately $116,000 and contingency for 25 percent less soil excavation was not included in the low cost for Alternative II-4).

7.3 Comparative Analysis of Alternatives For Area 3 Upland and Wetland

Comparative analyses of alternatives for the Area 3 upland and wetland at AOC 57 are presented in the following subsections and summarized in Table 7-2. The three remedial alternatives that are the focus of the comparative analysis are:

- Alternative III-1: No Action
- Alternative III-2: Limited Action
- Alternative III-3: Excavation (for Unrestricted Use) and Institutional Controls

7.3.1 Overall Protection of Human Health and the Environment

This criterion, according to CERCLA, must be met for a remedial alternative to be chosen as a final site remedy. At AOC 57 Area 3 upland and wetland, the human-health risk assessment identified risks in excess of USEPA's Superfund risk range and target HI from exposure to surface soils and groundwater. The EPH C11-C22 aromatic carbon range concentration exceeds its risk-based PRG in wetland soils only. Arsenic, cadmium and 1,4-DCB exceed MCL/MMCL-based PRGs in upland groundwater. Arsenic and PCE exceed MCL/MMCL-based PRGs in wetland groundwater. These soil and groundwater risk exceedances are based only upon possible future-use (commercial/industrial worker exposure to Area 3 groundwater) and unrestricted-use (residential exposure to wetland soil and Area 3 groundwater) scenarios. The risk assessment for assumed current site use (maintenance worker and recreational child) revealed that human-health risk was within

the USEPA's Superfund risk range and below the target HI. Land use is slated for commercial/industrial and recreation/open space and not residential. Furthermore residential use of wetland areas is highly improbable. Potable use of AOC 57 Area 3 groundwater is not expected since Devens is supplied with municipal water; however risk assessments for commercial/industrial and residential groundwater use were still performed for risk management considerations. Arsenic, which contributes greater than 90 percent to the carcinogenic risk from ingestion of groundwater at the site (Table 3-2), is believed to be naturally occurring but currently elevated from reducing conditions caused by biodegradation of organic site contaminants. The ecological risk assessment did not identify unacceptable risks to ecological receptors from exposure to sediments or surface water at Area 3.

Alternative III-1 was developed as a baseline with which to compare the other alternatives and proposes no action and, although protective of the environment, would not provide protection to human health. Alternatives III-2 and III-3 are protective of human health and the environment. These alternatives utilize institutional controls and environmental monitoring to protect receptors from potable use of contaminated groundwater at the site, but each provide a different means for protection from exposure to contaminated soil. Alternative III-2 utilizes institutional controls to restrict exposure to soil at the site. Deed restrictions would prohibit residential use of Area 3 wetland soil for protection of the unrestricted-use receptor. Alternative III-3 utilizes soil excavation and off-site treatment/disposal to protect the unrestricted-use receptor from exposure to soil.

7.3.2 Compliance with ARARs

CERCLA requires that the selected alternatives also meet a second threshold criterion of compliance with ARARs, or obtain a waiver if the criterion can not be met. This criterion, according to CERCLA, must be met for a remedial alternative to be chosen as a final site remedy.

Chemical-Specific ARARs. Groundwater COCs that exceed chemical-specific ARARs (e.g., MCLs, MMCLs and the Massachusetts Groundwater Quality Criteria [314 CMR 6.00]) are arsenic, cadmium, and 1,4-DCB and PCE. Chemical-specific ARARs would not be met by any of the alternatives in the short-term, but would be met by natural attenuation processes in the long-term. All the alternatives rely on the benefits of the former soil removal action and groundwater diffusion and dispersion to meet chemical-specific ARARs within the two monitoring wells where ARARs are marginally or sporadically exceeded. Alternatives III-2 and III-3 would use environmental monitoring to evaluate long-term effectiveness and the potential for COC migration off-site.

Soil PRGs were not established using promulgated guidance values and therefore are not considered ARARs.

Action-Specific ARARs. Alternative III-3 would need to meet action-specific ARARs because of the soil excavation component. Federal and state regulations pertaining to the handling, transportation and disposal of solid and hazardous wastes would be triggered because of the soil removal activities that would be performed as a component of Alternative III-3. Construction activities would also be controlled to meet federal and state regulations pertaining to the control of surface water runoff, and protection of surface water and air quality. Alternative III-2, which entails only implementing institutional controls and monitoring, would not trigger these ARARs.

Location-Specific ARARs. Alternative III-3 would need to meet federal and state regulations pertaining to the protection of wetland and floodplain areas because of the soil removal activities that would be performed in the vicinity of Lower Cold Spring Brook. Protection of endangered species may also need to be considered during the design and implementation of this alternative. Alternative III-2, which entails only implementing institutional controls and monitoring, would not trigger these ARARs.

7.3.3 Long-Term Effectiveness and Permanence

This criterion evaluates the magnitude of residual risk and the reliability of controls after response objectives have been met. Alternative III-1 does not provide long-term effectiveness and permanence for protecting human health from exposure to soil at Area 3 wetlands. Alternative III-2 relies on institutional controls to restrict human receptor exposure to soils containing COCs that exceed PRGs. Long-term maintenance of these controls would be essential to ensure long-term effectiveness. Alternative III-3 entails soil excavation to effectively and permanently minimize risk to human receptors. The excavation component in Alternative III-3 removes COCs that exceed unrestricted-use PRGs and would effectively and permanently minimize risk to residential receptors from exposure to contaminated soils, without the use of institutional controls. Therefore, of the three alternatives, Alternative III-3 provides the greatest degree of long-term effectiveness and permanence for protection from exposure to contaminated soils.

None of the alternatives provide active controls to reduce concentrations of COCs in groundwater at Area 3 uplands and wetlands. However, groundwater conditions are expected to continue to improve at the site as a result of the former soil removal action at the source area. Alternative III-2 and III-3 provide long-term environmental monitoring to assess the effectiveness and permanence of achieving PRGs in groundwater. Until groundwater PRGs are achieved, Alternatives III-2 and III-3 provide institutional controls to restrict commercial/industrial and residential exposure to groundwater. Alternative III-1 utilizes the same natural groundwater processes as the other alternatives but provides no means for monitoring the effectiveness and permanence of groundwater processes. It also does not provide institutional controls to restrict exposure to groundwater during the period when groundwater PRGs are exceeded.

7.3.4 Reduction of Toxicity, Mobility, or Volume Through Treatment

This criterion evaluates whether the alternatives meet the statutory preference for treatment under CERCLA. The criterion evaluates the reduction of toxicity, mobility, or volume of contaminants, and the type and quantity of treatment residuals.

Alternatives III-1 and III-2 do not employ active removal or treatment processes to address soil contamination and therefore would not satisfy CERCLA's statutory preference for treatment as a principal component for soil remedial action. Alternative III-3 employs active removal processes and off-site treatment/disposal at a licensed TSD facility to address soil contamination and therefore satisfies CERCLA's statutory preference for treatment. Alternative III-3 would remove COCs in soil that exceed unrestricted-use PRGs and therefore provides the greatest degree of reduction in toxicity, mobility and volume through treatment.

For reduction of toxicity and volume of groundwater COCs, all alternatives rely principally on the natural processes of diffusion and dispersion following the former soil removal action to regain upgradient water quality (i.e., ORP) conditions. Regaining upgradient groundwater conditions will decrease the solubility of naturally occurring arsenic, the major risk contributor in groundwater at the site.

7.3.5 Short-Term Effectiveness

CERCLA requires that potential adverse short-term effects to workers, the surrounding community, and the environment be considered during selection of a remedial action. Alternative III-2 provides the least adverse short-term effects of all the alternatives. Alternative III-2 includes applying land-use restrictions to minimize human exposure to site soils. Because this alternative does not provide active or intrusive remedial actions, there would be no significant risk to the community, site workers, or the environment during implementation. Alternative III-1 does not provide any remedial actions; therefore, short-term risks to the community or environment would not result from implementation. However, soil exposure would not be restricted and therefore it would not provide short-term protection should residential development be permitted in the Area 3 wetland. Alternative III-3 includes excavation of site soils as a component, which increases the potential risks to remedial workers. Personal protective equipment and engineering controls (dust control) would be required to minimize risk to workers and exposure to downwind receptors. Soils would be transported to the TSD facility following federal and state regulations. Alternative III-3 would also have the greatest short-term impacts on the wetlands due to the excavation activities that would likely be performed in within the wetland area.

Alternatives III-2 and III-3 include applying land-use restrictions prohibiting potable groundwater use and performing long-term environmental monitoring. When routinely

implemented and checked, these actions protect site workers and the community until PRGs in groundwater are achieved.

7.3.6 Implementability

This criterion evaluates each alternative's ease of construction and operation, and availability of services, equipment, and materials to construct and operate the alternative. Also evaluated is the ease of undertaking additional remedial actions and administrative feasibility.

Although the engineering/implementation complexity increases for each alternative, (i.e., Alternative III-3 > Alternative III-2 > Alternative III-1), engineering and construction services, equipment, and materials are readily available to implement any of the alternatives. Alternative III-1 requires no remedial action. Alternative II-2 requires only the implementation of institutional controls, which should be readily enforceable given Area 3's location with respect to wetlands. Alternative III-3 is greater in complexity due to the additional soil excavation and wetlands restoration components.

None of the alternatives would limit or interfere with the ability to perform future remedial actions.

7.3.7 Cost

There are no costs associated with Alternative III-1. Capital, O&M, and present worth costs were estimated for Alternatives III-2 and III-3. Cost estimates for these alternatives include similar expense for long-term environmental monitoring. As would be expected, the NPW for Alternative III-2 (at approximately $298,000) is less than the NPW for Alternative III-3 (at approximately $387,000) because Alternative III-2 does not include a soil excavation component.

Comparison of the NPW costs over 30 years reveals that the benefit of achieving unrestricted-use PRGs in soil (difference between Alternatives III-2 and III-3) costs approximately $89,000.

If it is assumed that groundwater PRGs can be achieved within 7 years (i.e., eliminating the need for institutional control inspections and 5-year site reviews in Alternative III-3 after 7 years), the benefit of achieving unrestricted-use PRGs in soil costs approximately $60,000. (Note for this comparison, the low costs for Alternatives III-3 and III-2 are compared without considering the capital cost decrease of approximately $6,000 and contingency for 33 percent less soil excavation for Alternative III-3.)

ABB-ES	ABB Environmental Services, Inc.
ADL	Arthur D. Little, Inc.
AOC	Area of Contamination
AREE	area requiring environmental evaluation
ARAR	applicable or relevant and appropriate requirements
AWQC	Ambient Water Quality Criteria
BEHP	bis (2-ethylhexl)phthalate
BERA	Baseline Ecological Risk Assessment
bgs	below ground surface
BOL	Bill of Lading
BRAC	Base Realignment and Closure
cm/sec	centimeters per second
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CMR	Code of Massachusetts Regulations
COC	contaminant of concern
CPC	chemical of potential concern
cy	cubic yards
EPC	exposure point concentration
EPH	Extractable Petroleum Hydrocarbons
ESMA	Excavated Soils Management Area
ft/ft	feet per foot
ft/min	feet per minute
ft/day	feet per day
FFS	Focused Feasibility Study
FS	Feasibility Study
HASP	Health and Safety Plan
HI	hazard index
HLA	Harding Lawson Associates
HQ	hazard quotient
IDW	investigation-derived waste
kg	kilograms
LTMP	Long-term Monitoring Plan
MADEP	Massachusetts Department of Environmental Protection

GLOSSARY OF ACRONYMS AND ABBREVIATIONS

MCL	Maximum Contaminant Level
MCP	Massachusetts Contingency Plan
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
MMCL	Massachusetts Maximum Contaminant Level
NCP	National Contingency Plan
NFA	no further action
NPW	net present worth
PAH	polynuclear aromatic hydrocarbon
PCB	polychlorinated biphenyl
PCE	tetrachloroethene
PID	photoionization detector
PRE	preliminary risk evaluation
PRG	preliminary remediation goals
QC	quality control
RAO	remedial action objectives
RBC	risk-based concentration
RFTA	Reserve Forces Training Area
RI	Remedial Investigation
RME	reasonable maximum exposure
ROD	Record of Decision
SA	Study Area
SARA	Superfund Amendments and Reauthorization Act
SDWA	Safe Drinking Water Act
SI	Site Investigation
SMCL	Secondary Maximum Contaminant Level
SVOC	semivolatile organic compound
TBC	to be considered
TEX	toluene, ethylbenzene and xylenes
TPHC	total petroleum hydrocarbons
TSCA	Toxic Substance Control Act
TSD	treatment, storage and disposal
TSS	total suspended solids
mg/kg	micrograms per gram
µg/L	micrograms per liter
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency

UST	underground storage tank
VPH	volatile petroleum hydrocarbons
VOC	volatile organic compound

REFERENCES

ABB Environmental Services, Inc., 1995a. "Revised Final Site Investigation Report - Groups 2, 7, and Historic Gas Stations, Fort Devens, Massachusetts"; Data Item A009; prepared for Commander, U.S. Army Environmental Center; prepared by ABB Environmental Services, Inc., Portland, Maine; October 1995.

ABB Environmental Services, Inc., 1995b. "Lower Cold Spring Brook Site Investigation Report, Fort Devens, Massachusetts"; Data Item A009; prepared for Commander, U.S. Army Environmental Center; prepared by ABB Environmental Services, Inc., Portland, Maine; December 1995.

Arthur D. Little, Inc. (ADL), 1994. Final Storm Sewer System Evaluation (AREE 70) Evaluation. Base Realignment and Closure Environmental Evaluation. Fort Devens, Massachusetts. Prepared for the U.S. Army Environmental Center (AEC). June 1994.

Biang, C.A., R.W. Peters, R.H. Pearl, and S.Y. Tsai, 1992. "Master Environmental Plan for Fort Devens, Massachusetts"; prepared for U.S. Army Toxic and Hazardous Materials Agency; prepared by Argonne National Laboratory, Environmental Assessment and Information Sciences Division; Argonne, Illinois; April.

Borden, Robert C., Gomez, Carlos A., and Becker, Mark T. 1995. "Geochemical Indicators of Intrinsic Bioremediation". Groundwater, Vol. 33, No. 2, March-April 1995; Pages 180-189.

Harding Lawson Associates (HLA), 2000. "Draft Final Remedial Investigation Report, Area of Contamination (AOC) 57" Contract DACA-31-94-D-0061; prepared for U.S. Army Corps of Engineers, New England District, Concord, Massachusetts; June.

Harding Lawson Associates (HLA), 1999. "Action Memorandum, Area of Contamination (AOC) 57, Devens, Massachusetts" Contract DACA-31-94-D-0061; prepared for U.S. Army Corps of Engineers, New England District, Concord, Massachusetts; February.

Massachusetts Department of Environmental Protection, (MADEP), 1999. "Drinking Water Standards and Guidelines for Chemicals in Massachusetts Drinking Waters"; Office of Research and Standards, Boston, MA.

Massachusetts Department of Environmental Protection (MADEP), 1997. "Massachusetts Contingency Plan", 310 CMR 40.000. Effective May 1997 (inclusive of revisions up to October 29, 1999).

Massachusetts Government Land Bank (MassDevelopment), (1998). "Industrial

Pretreatment Enforcement Response Program for the Devens Wastewater System Devens, Massachusetts"; June 11.

McAllister, P.M. and Chiang, C.Y. "A Practical Approach to Evaluating Natural Attenuation of Contaminants in Ground Water". GWMR Spring 1994. Pages 161-173.

Robinson, P. and R. Goldsmith, 1991. "Stratigraphy of the Merrimack Belt, Central Massachusetts." In *The Bedrock Geology of Massachusetts*. U.S. Geological Survey Professional Paper 1366-G. pp. 61-637.

U.S. Environmental Protection Agency (USEPA), 1988. "Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA"; USEPA Office of Emergency and Remedial Response, EPA/540/G-89/004, OSWER Directive 9355.3-01; October.

U.S. Environmental Protection Agency (USEPA), 1990. Code of Federal Regulations, Title 40, Part 300, National Oil and Hazardous Substances Pollution Contingency Plan; Federal Register; March 8.

U.S. Environmental Protection Agency (USEPA), 1991. Risk Assessment Guidance for Superfund. Volume I: Human Health Evaluation Manual (Part B, Development of Risk-based Preliminary Remediation Goals). Publication 9298.7-013. December 1991 and Revision October 1992.

U.S. Environmental Protection Agency (USEPA), 1993a. "Amendment to the National Oil and Hazardous Substances Pollution Contingency Plan; Procedures for Planning and Implementing Off-site Response Actions, Final Rule"; Title 40, Part 300; Federal Register; Volume 58, Number 182; pp 49200 et seq.; September 22.

U.S. Environmental Protection Agency (USEPA), 1993b. "Revisions to OMB Circular A-94 on Guidelines and Discount Rates for Benefit-Cost Analysis" ; Office of Solid Waste and Emergency Response; OSWER Directive 9355.3-20; Washington, D.C.; June 25, 1993.

U.S. Environmental Protection Agency (USEPA), 1994. "Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities"; Office of Solid Waste and Emergency Response, OWSER Directive 9355.4-12; July 1994.

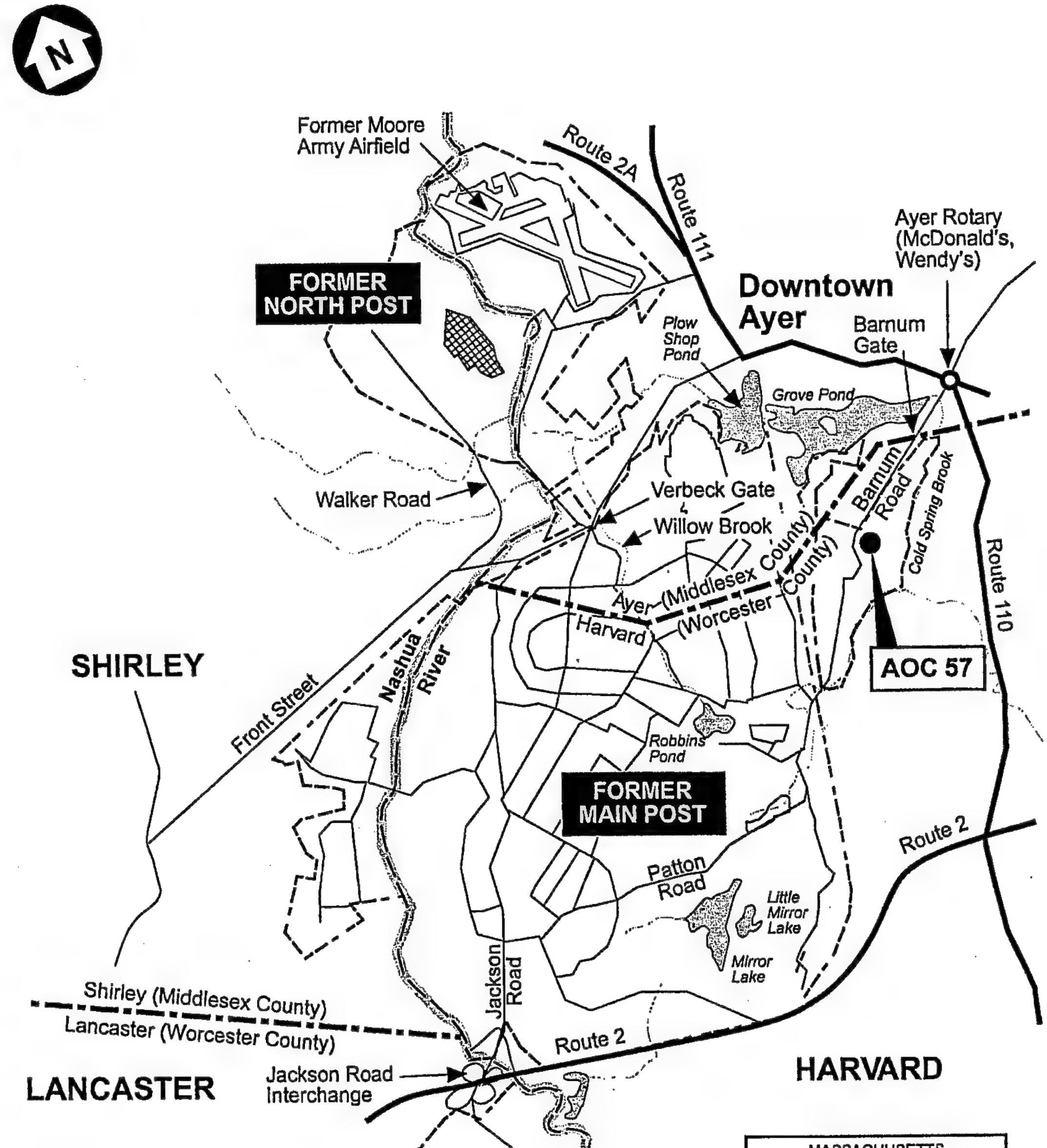
U.S. Environmental Protection Agency (USEPA), 1996. Drinking Water Regulations and Health Advisories. Office of Water, Washington, DC. February 1996.

Vanasse Hangen Brustlin, Inc., 1994. Devens Reuse Plan. Prepared for the Boards of Selectmen of the Towns of Ayer, Harvard, Lancaster, and Shirley and the Massachusetts Government Land Bank. November 14, 1994.

REFERENCES

Weston, Roy F., Inc. 1998. "Contaminated Soil Removal – Phase II, Study Area 57, Area 1, Storm Drain System No. 6 Outfall, Removal Action Report". July 1998.

Zen, E-an, Ed., 1983. "Bedrock Geologic Map of New England." U.S. Geological Survey; Scale 1:250,000; three sheets.



Legend

- Site Location
- Installation Boundary
- Town Line
- Brook
- Pond/Lake
- Roads/Highway

Scale in Feet

0 3,000 6,000

FIGURE ES-1
LOCATION OF AOC 57
FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MASSACHUSETTS

Harding Lawson Associates

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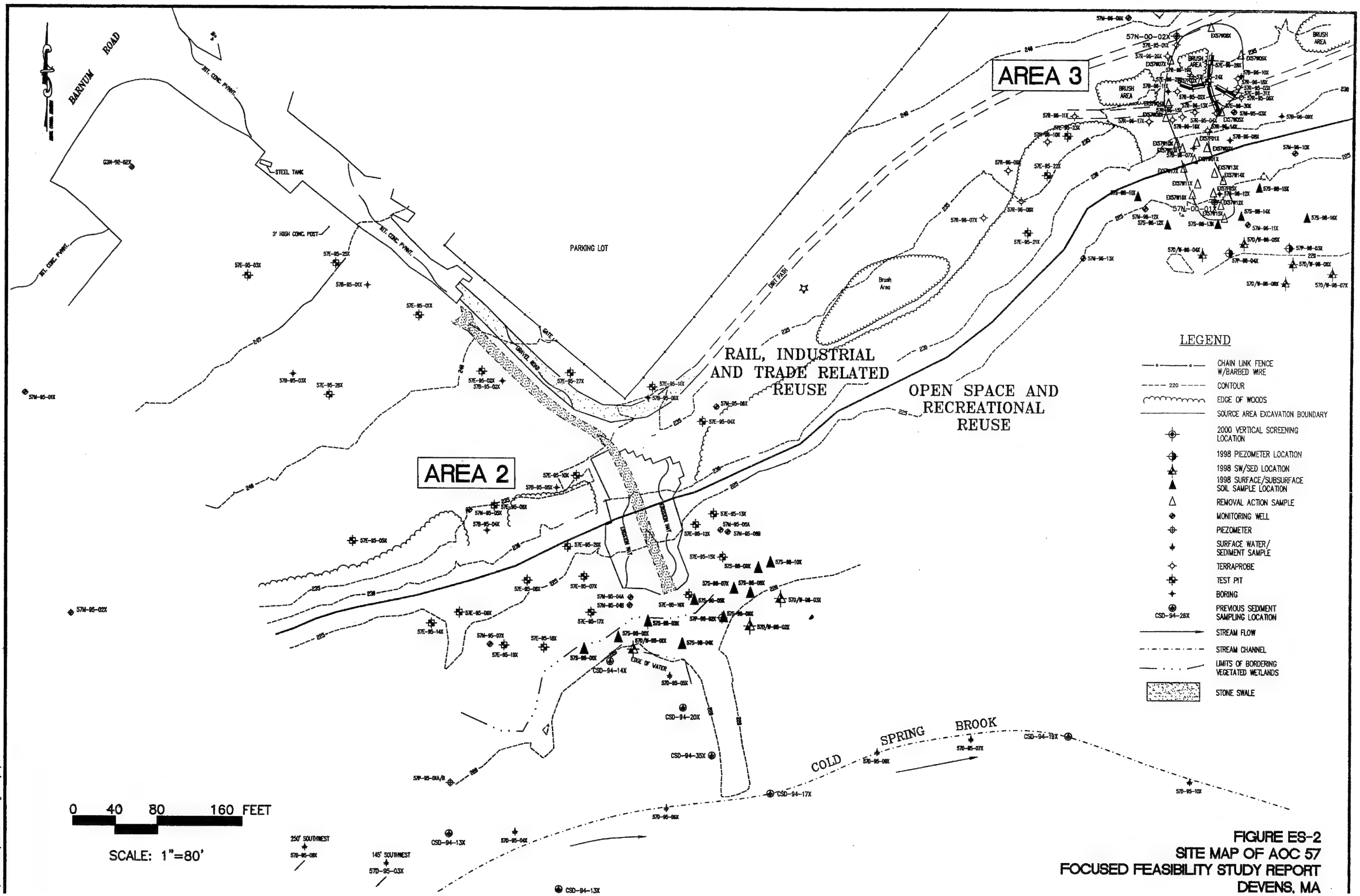

FIGURE ES-2
SITE MAP OF AOC 57
FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MA

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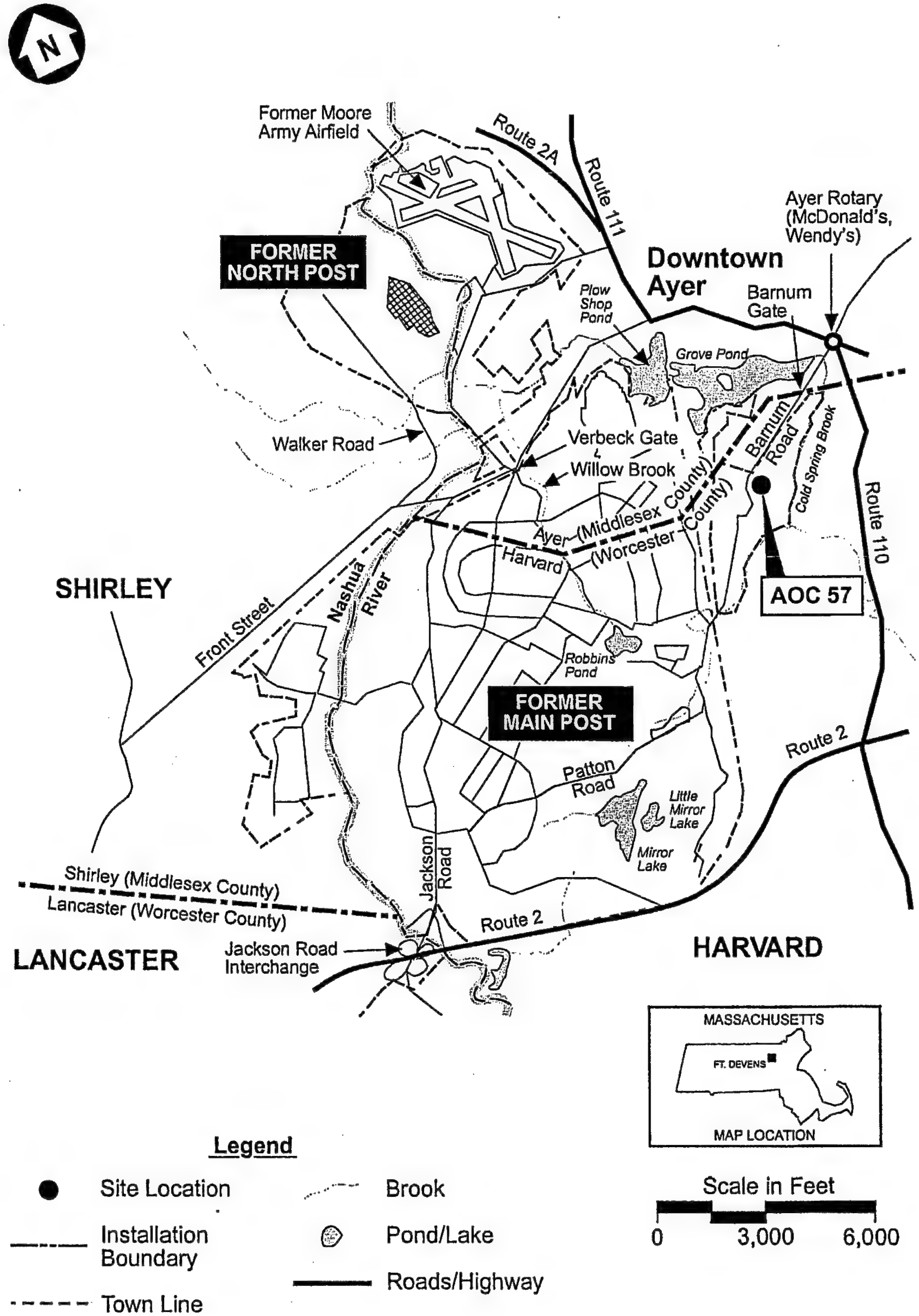

FIGURE 1-1
LOCATION OF AOC 57
FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MASSACHUSETTS

Harding Lawson Associates

W2000012(a)

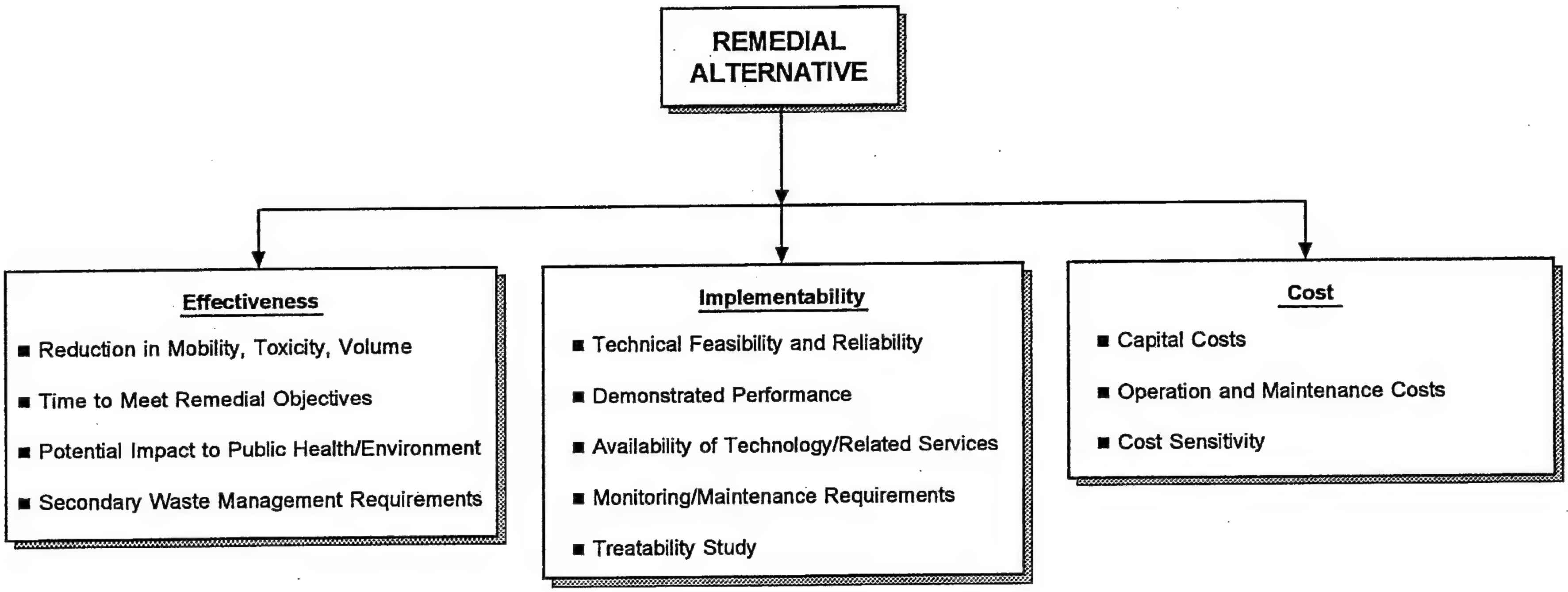

FIGURE 1-2
REMEDIAL ALTERNATIVE SCREENING CRITERIA
AOC 57 FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MA

Harding Lawson Associates

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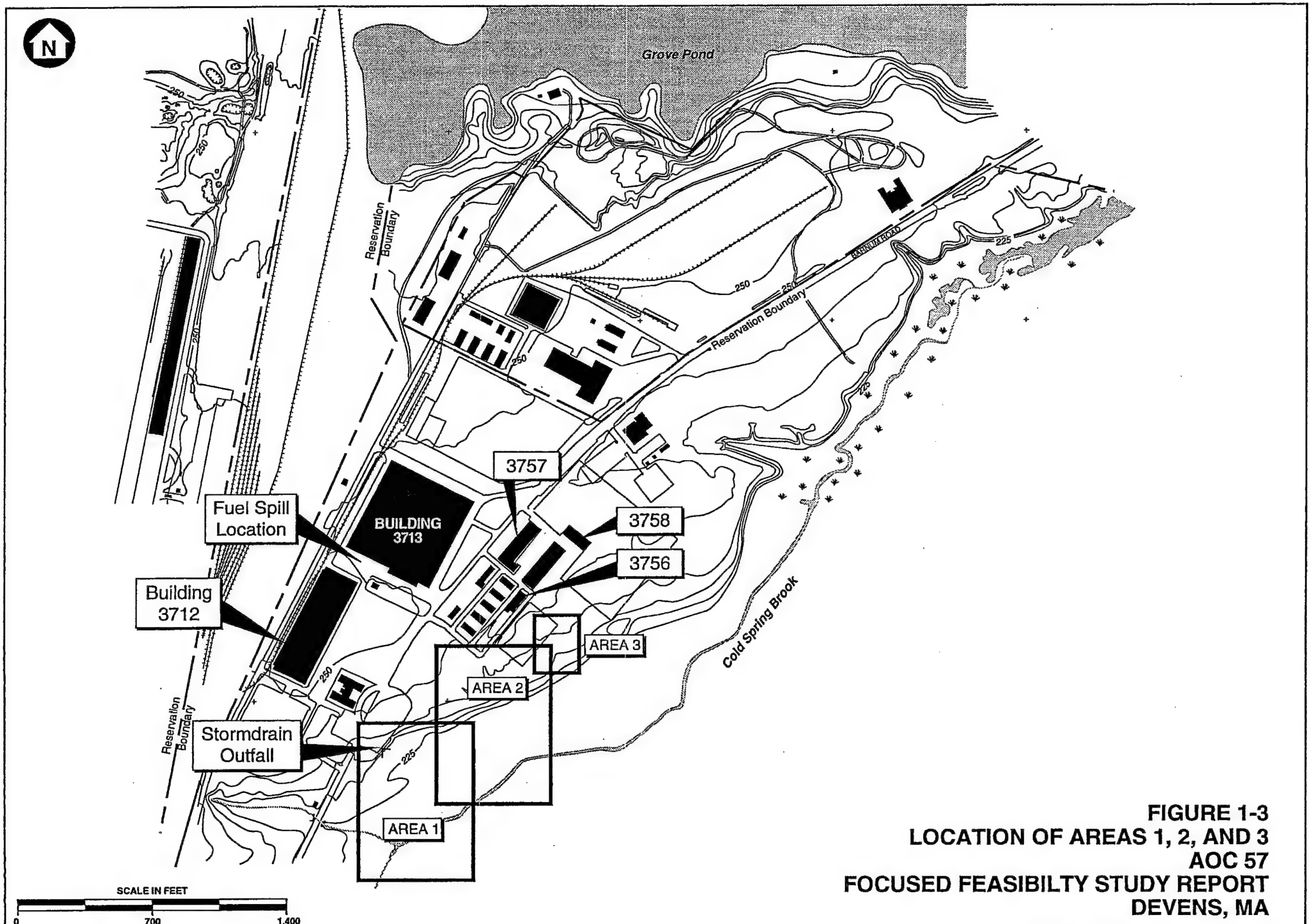

FIGURE 1-3
LOCATION OF AREAS 1, 2, AND 3
AOC 57
FOCUSED FEASIBILTY STUDY REPORT
DEVENS, MA

Harding Lawson Associates

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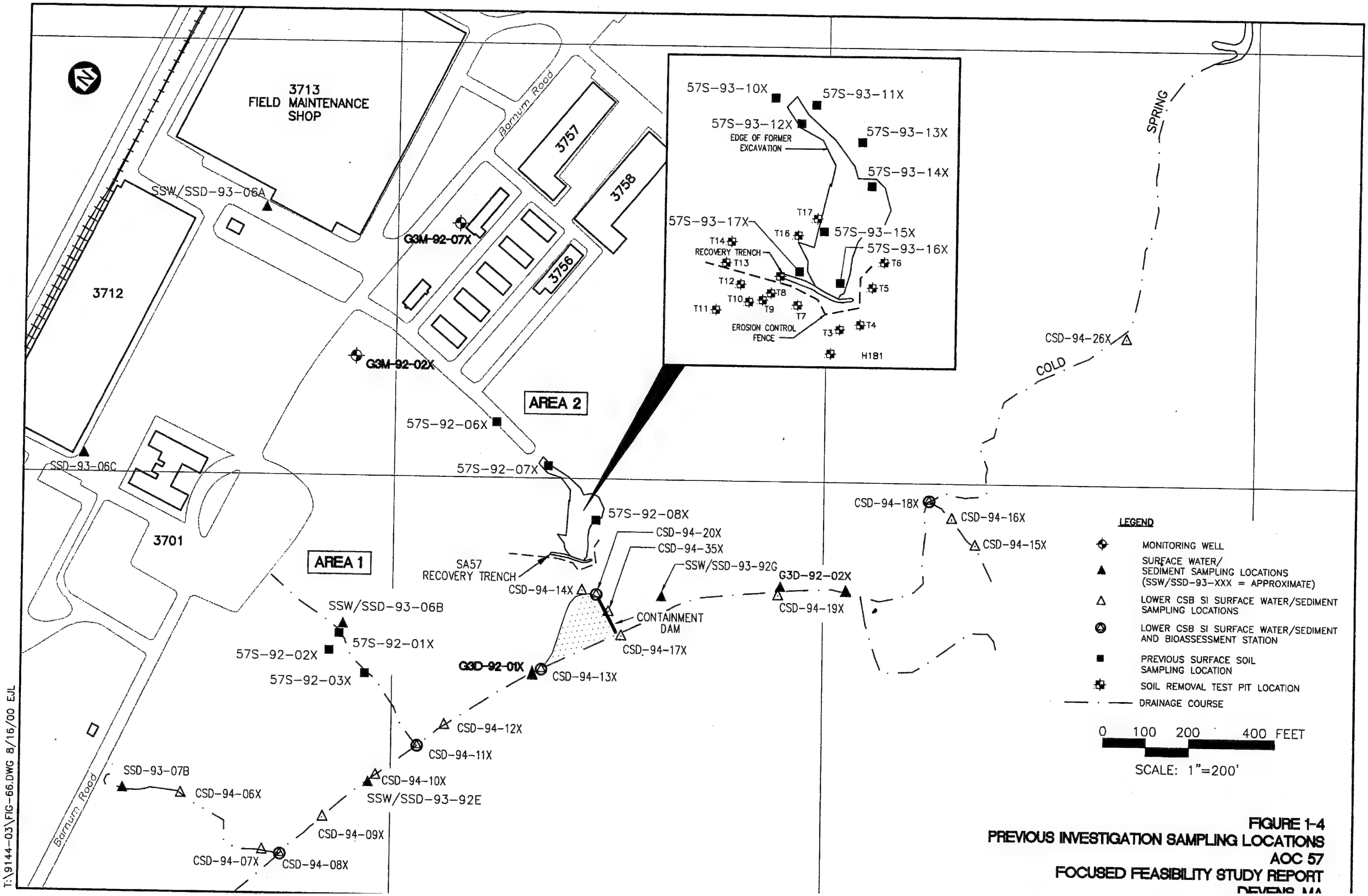

FIGURE 1-4
PREVIOUS INVESTIGATION SAMPLING LOCATIONS
AOC 57
FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MA

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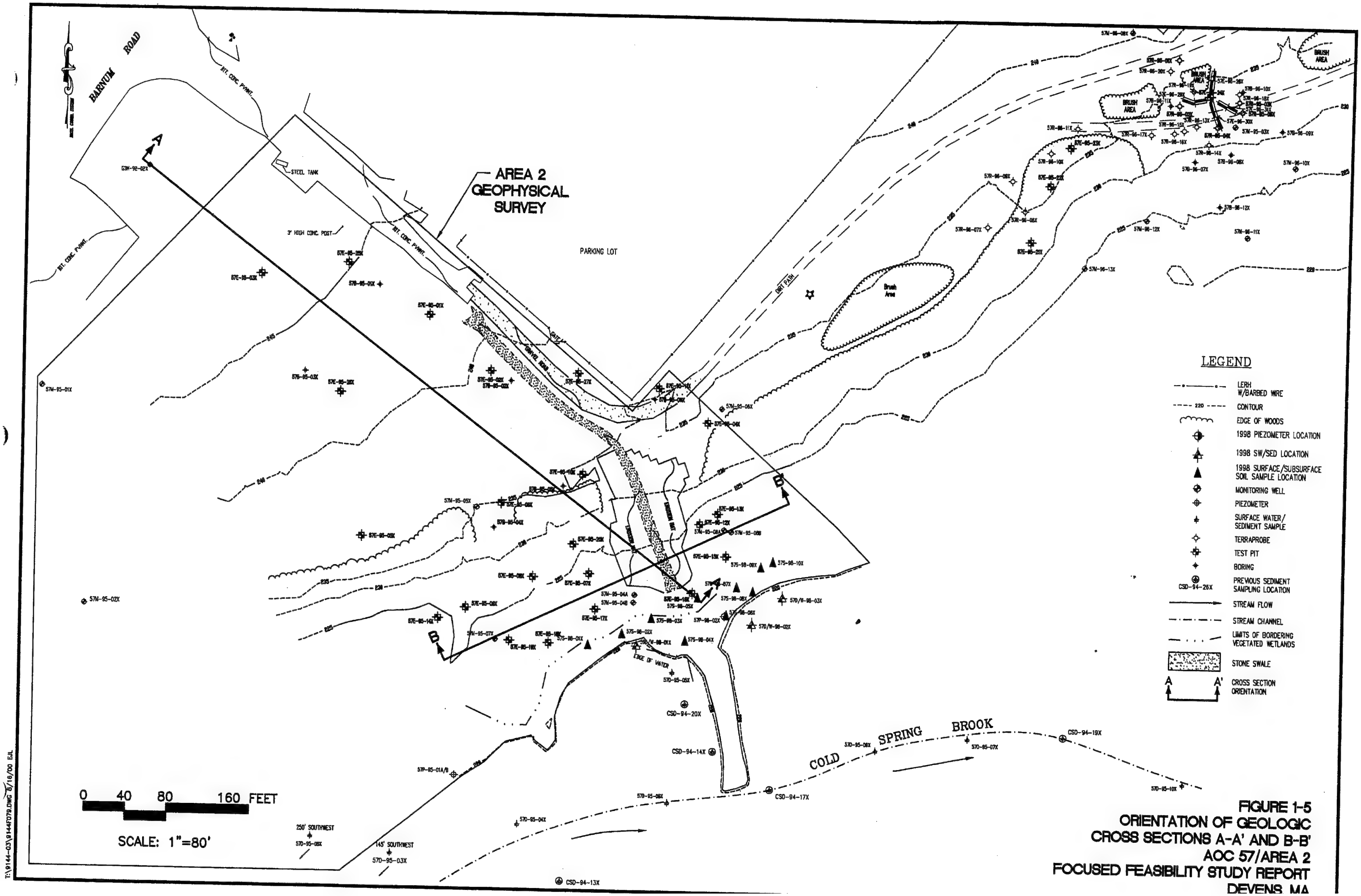

FIGURE 1-5
ORIENTATION OF GEOLOGIC
CROSS SECTIONS A-A' AND B-B'
AOC 57/AREA 2
FOCUSED FEASIBILITY STUDY REPORT
DEVENS MA

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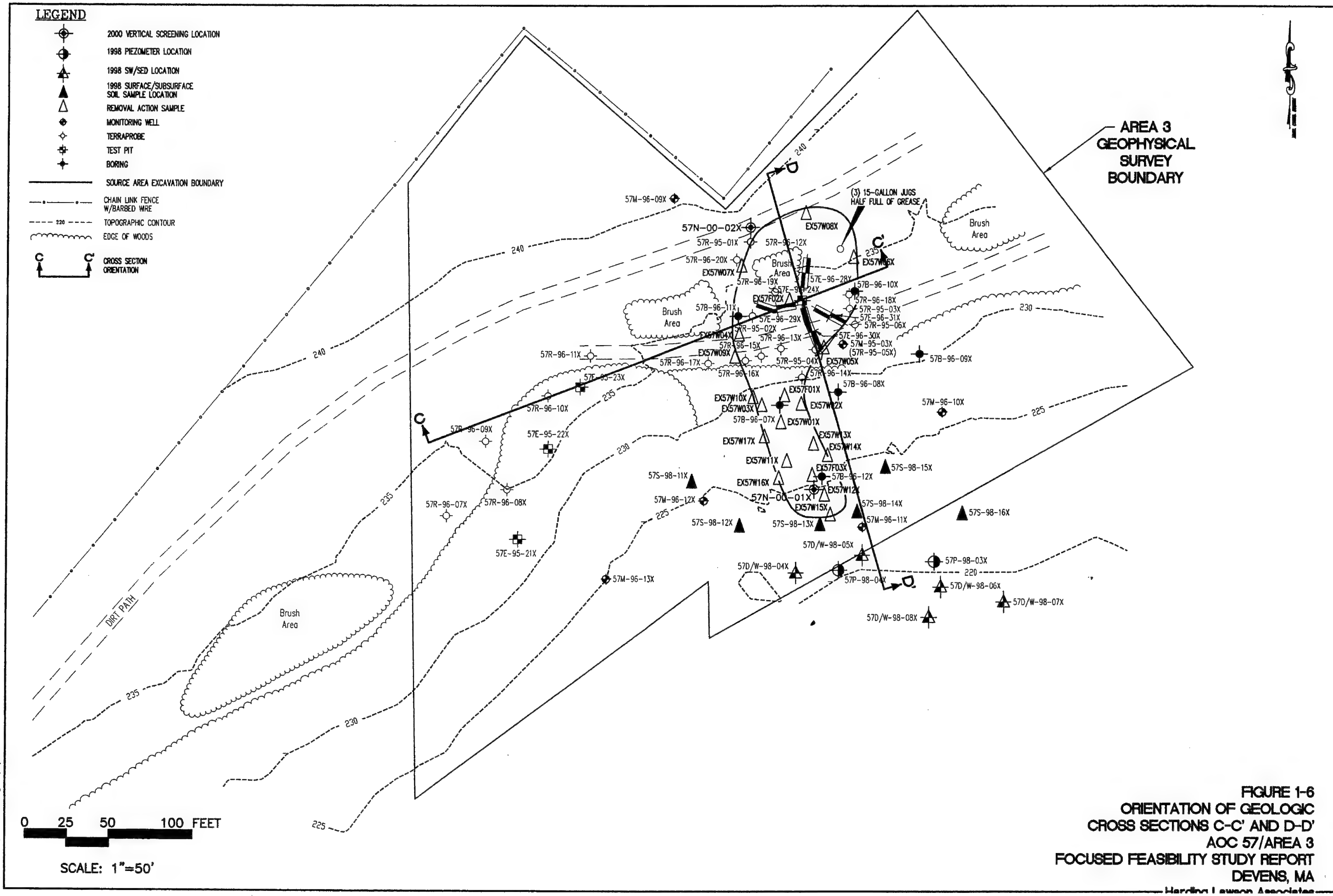
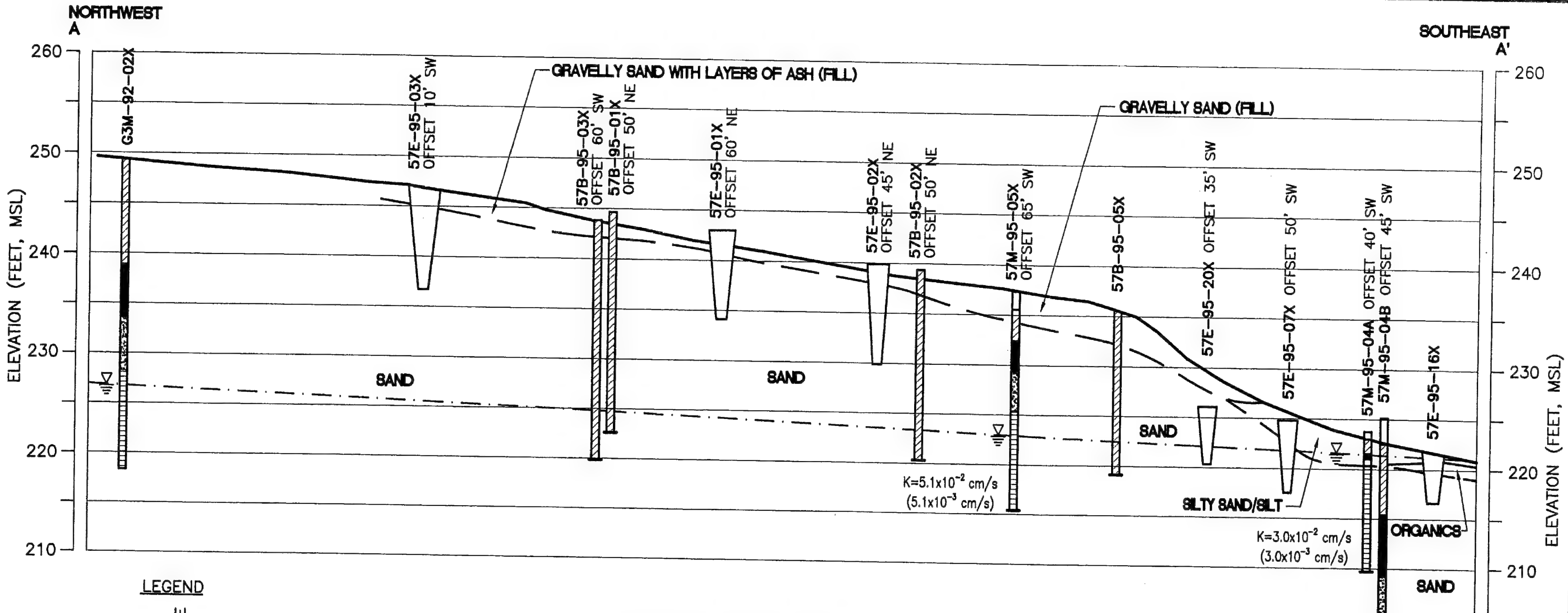
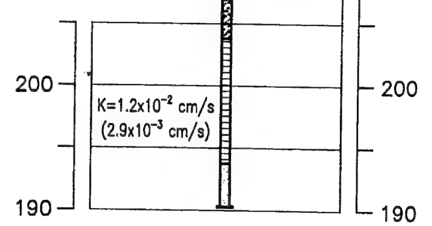
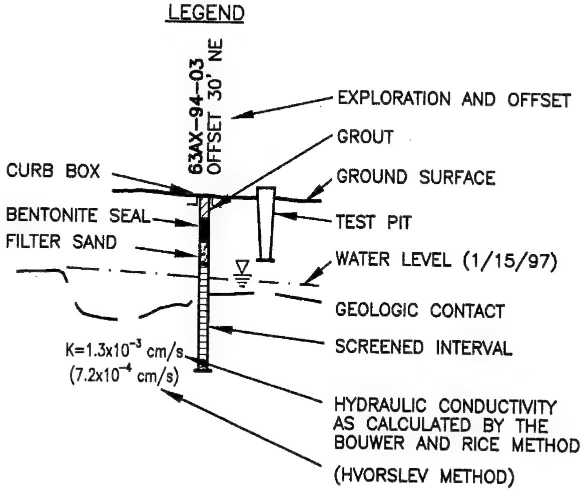


FIGURE 1-6
ORIENTATION OF GEOLOGIC
CROSS SECTIONS C-C' AND D-D'
AOC 57/AREA 3
FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MA

Harding Lawson Associates



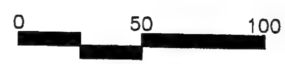




CROSS SECTION A - A'

NOTES:

1. FOR ORIENTATION OF CROSS SECTION, SEE FIGURE 1-5.
2. GEOLOGIC CONDITIONS BETWEEN EXPLORATIONS ARE AN INTERPRETATION OF AVAILABLE DATA. ACTUAL CONDITIONS MAY VARY.
3. MSL = MEAN SEA LEVEL



HORIZONTAL SCALE: 1"=50'
VERTICAL SCALE: 1"=10'
VERTICAL EXAGGERATION: 5:1

FIGURE 1-7
INTERPRETIVE GEOLOGIC CROSS SECTION A-A'
AOC 57/AREA 2
FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MA

Harding Lawson Associates

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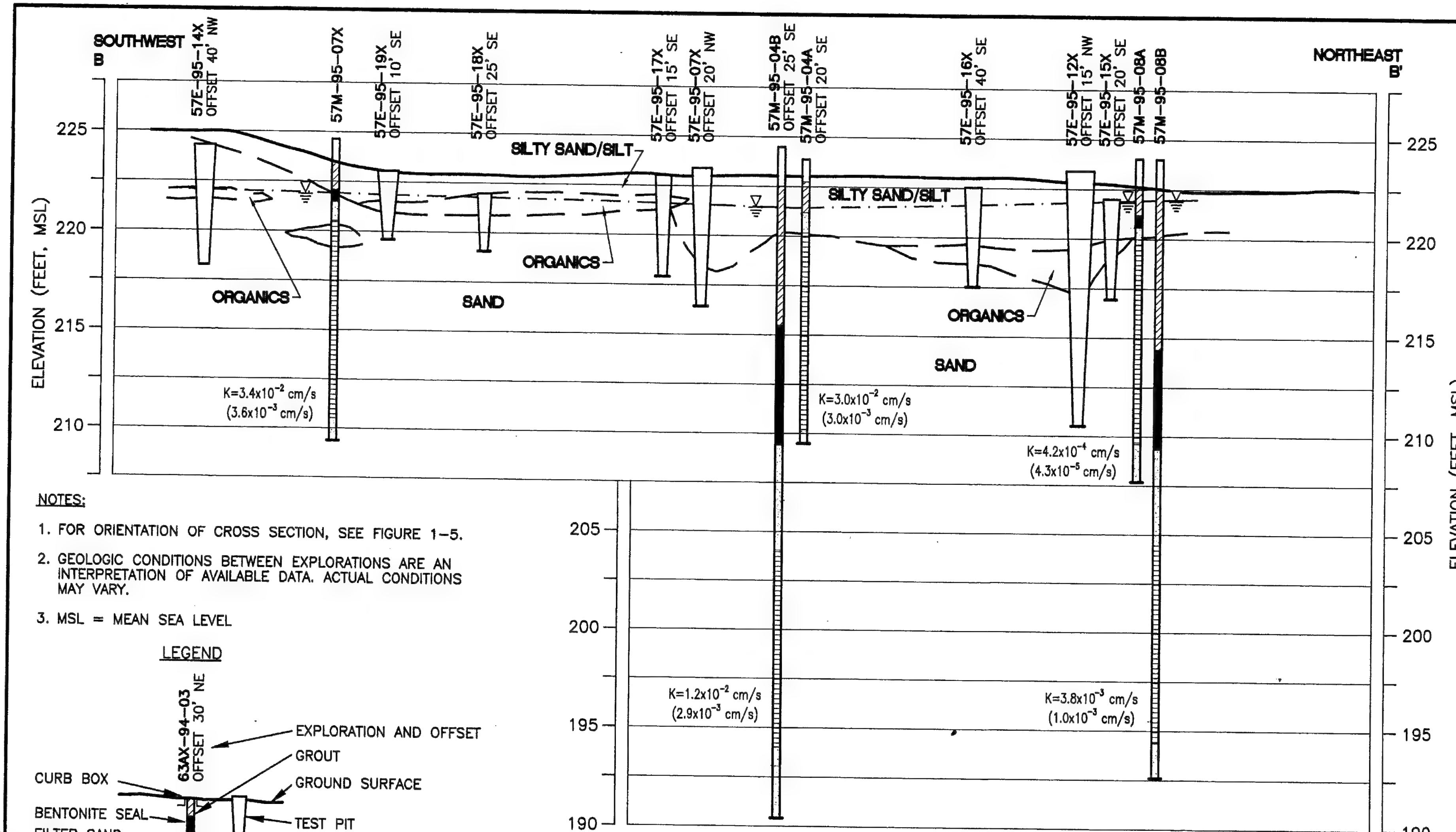
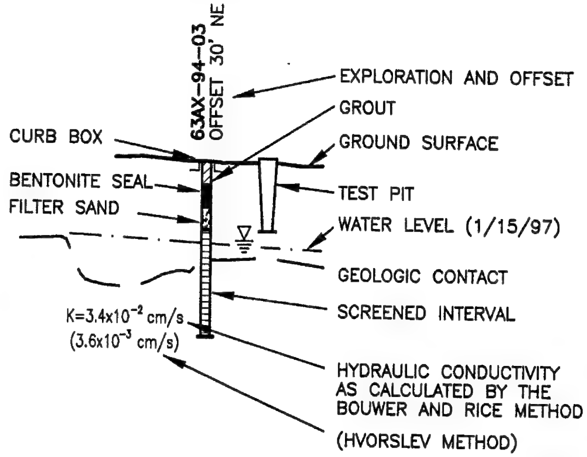


NOTES:

1. FOR ORIENTATION OF CROSS SECTION, SEE FIGURE 1-5.
2. GEOLOGIC CONDITIONS BETWEEN EXPLORATIONS ARE AN INTERPRETATION OF AVAILABLE DATA. ACTUAL CONDITIONS MAY VARY.
3. MSL = MEAN SEA LEVEL

LEGEND



CROSS SECTION B - B'

0 30 60

HORIZONTAL SCALE: 1"=30'
VERTICAL SCALE: 1"=5'
VERTICAL EXAGGERATION: 6:1

FIGURE 1-8
INTERPRETIVE GEOLOGIC CROSS SECTION B-B'
AOC 57/AREA 2
FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MA

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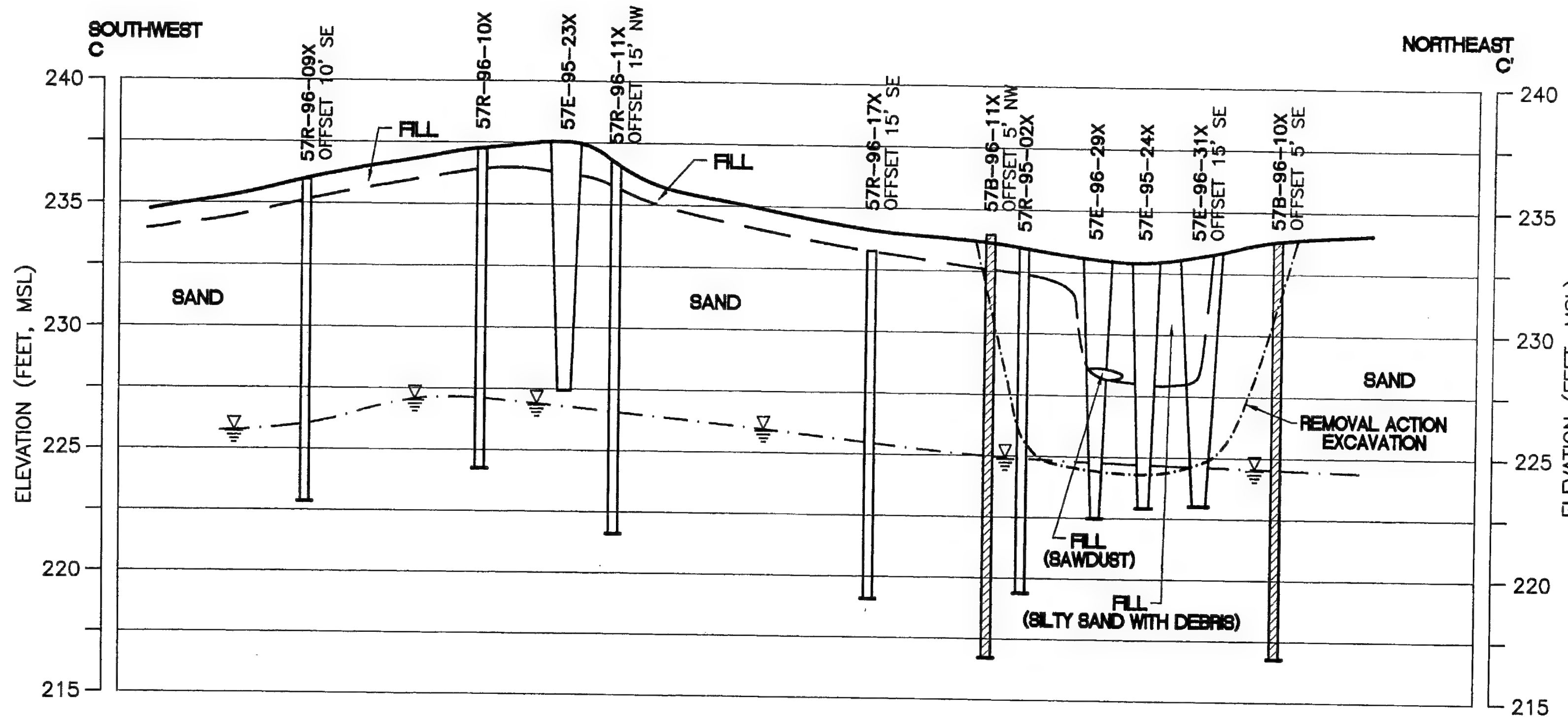
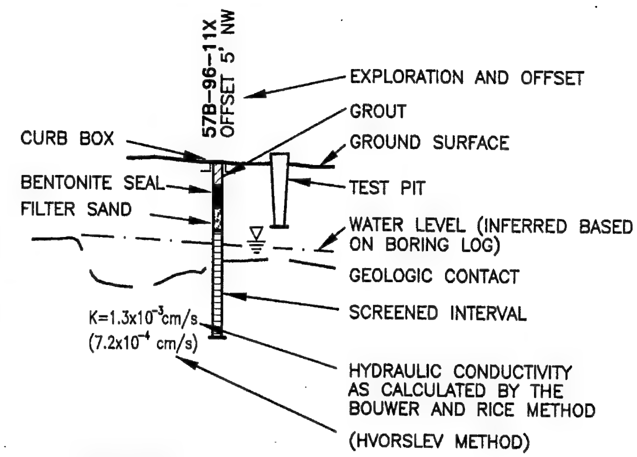


LEGEND



CROSS SECTION C - C'

NOTES:

1. FOR ORIENTATION OF CROSS SECTION, SEE FIGURE 1-6.
2. GEOLOGIC CONDITIONS BETWEEN EXPLORATIONS ARE AN INTERPRETATION OF AVAILABLE DATA. ACTUAL CONDITIONS MAY VARY.
3. MSL = MEAN SEA LEVEL

HORIZONTAL SCALE: 1"=30'
VERTICAL SCALE: 1"=5'
VERTICAL EXAGGERATION: 6:1

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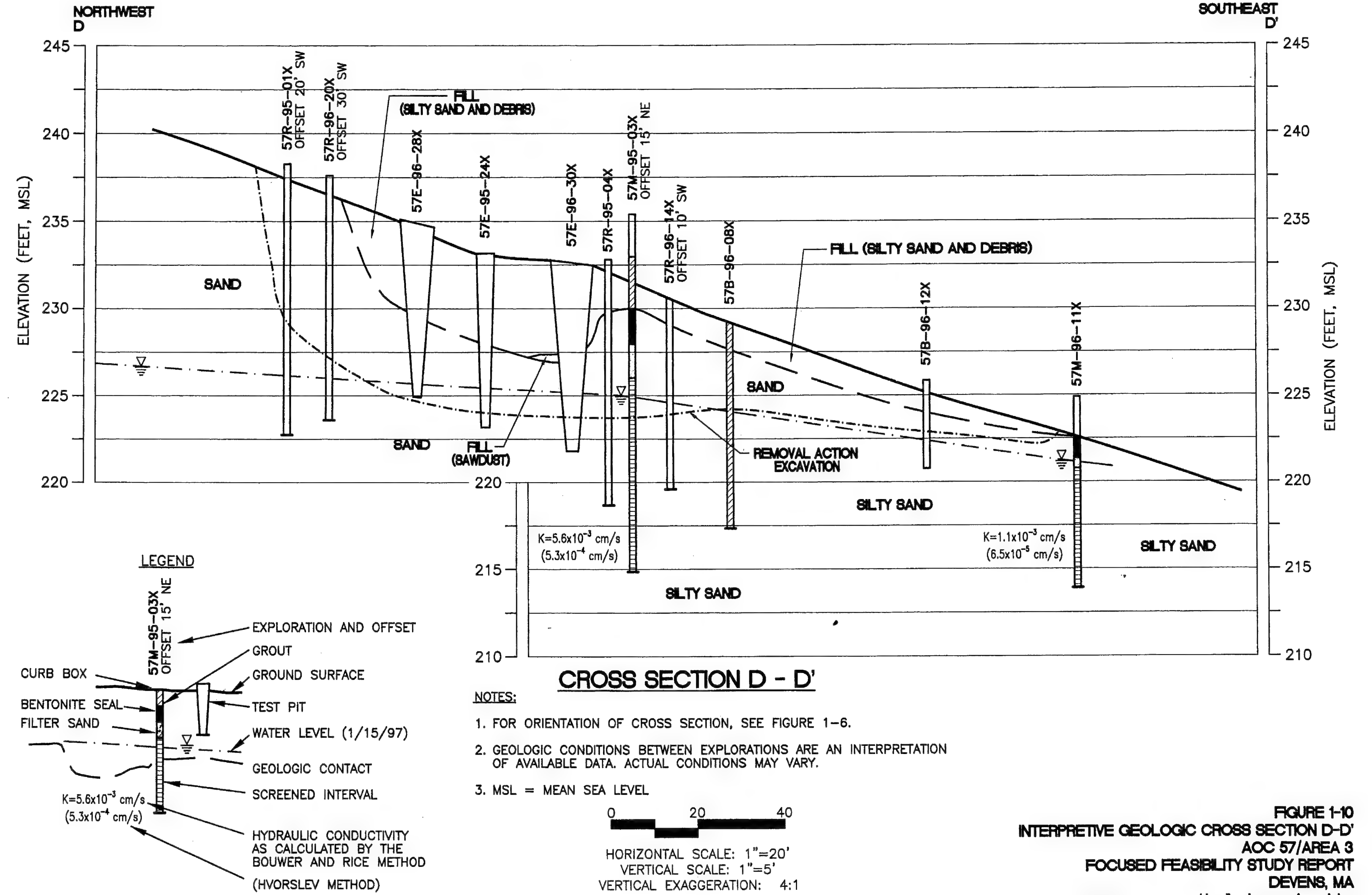
FIGURE 1-9
INTERPRETIVE GEOLOGIC CROSS SECTION C-C'
AOC 57/AREA 3
FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MA



CROSS SECTION D - D'

NOTES:

1. FOR ORIENTATION OF CROSS SECTION, SEE FIGURE 1-6.
2. GEOLOGIC CONDITIONS BETWEEN EXPLORATIONS ARE AN INTERPRETATION OF AVAILABLE DATA. ACTUAL CONDITIONS MAY VARY.
3. MSL = MEAN SEA LEVEL

0 20 40

HORIZONTAL SCALE: 1"=20'
VERTICAL SCALE: 1"=5'
VERTICAL EXAGGERATION: 4:1

FIGURE 1-10
INTERPRETIVE GEOLOGIC CROSS SECTION D-D'
AOC 57/AREA 3
FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MA
Harding Lawson Associates

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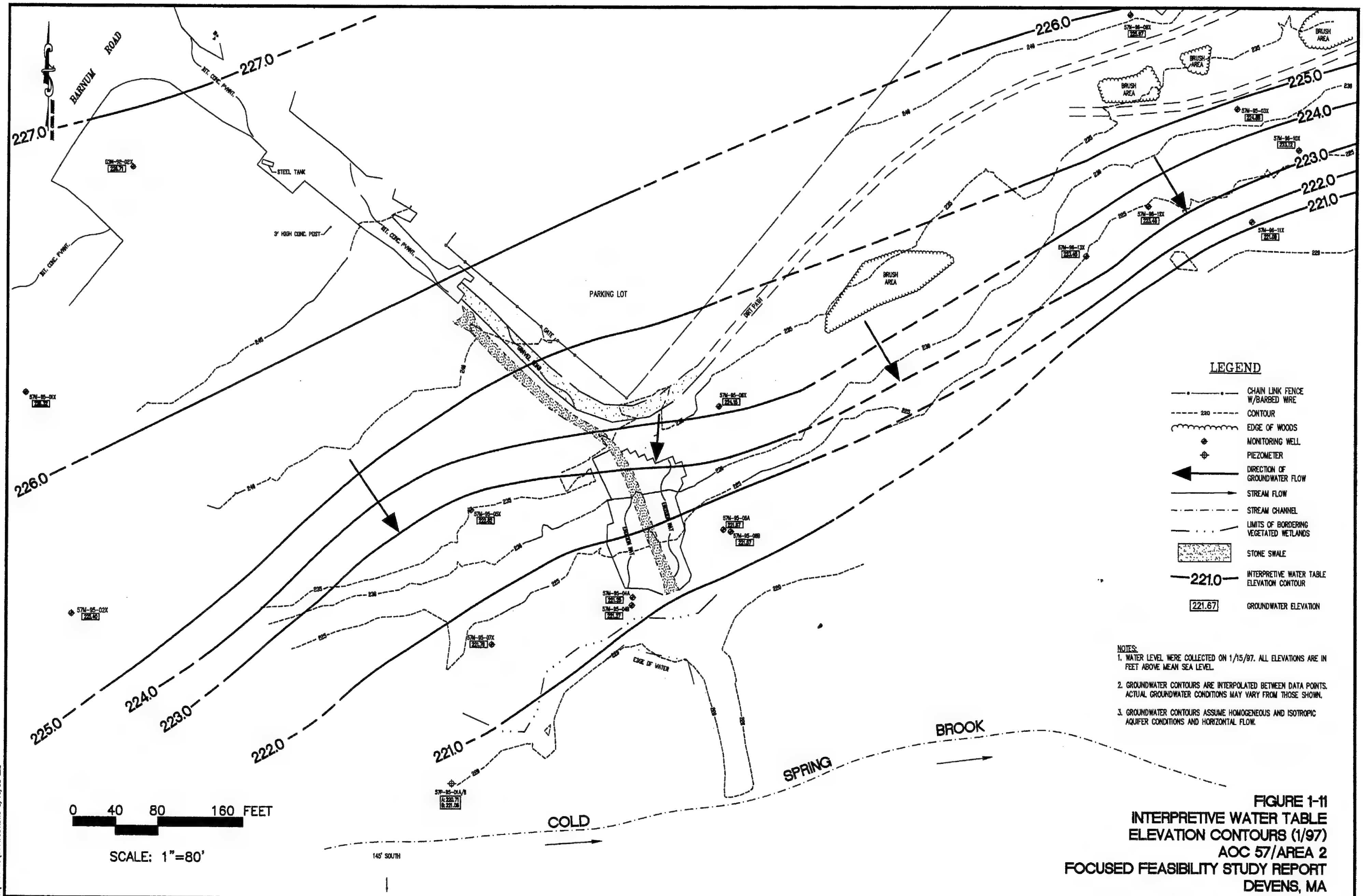


FIGURE 1-11
INTERPRETIVE WATER TABLE ELEVATION CONTOURS (1/97)
AOC 57/AREA 2
FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MA

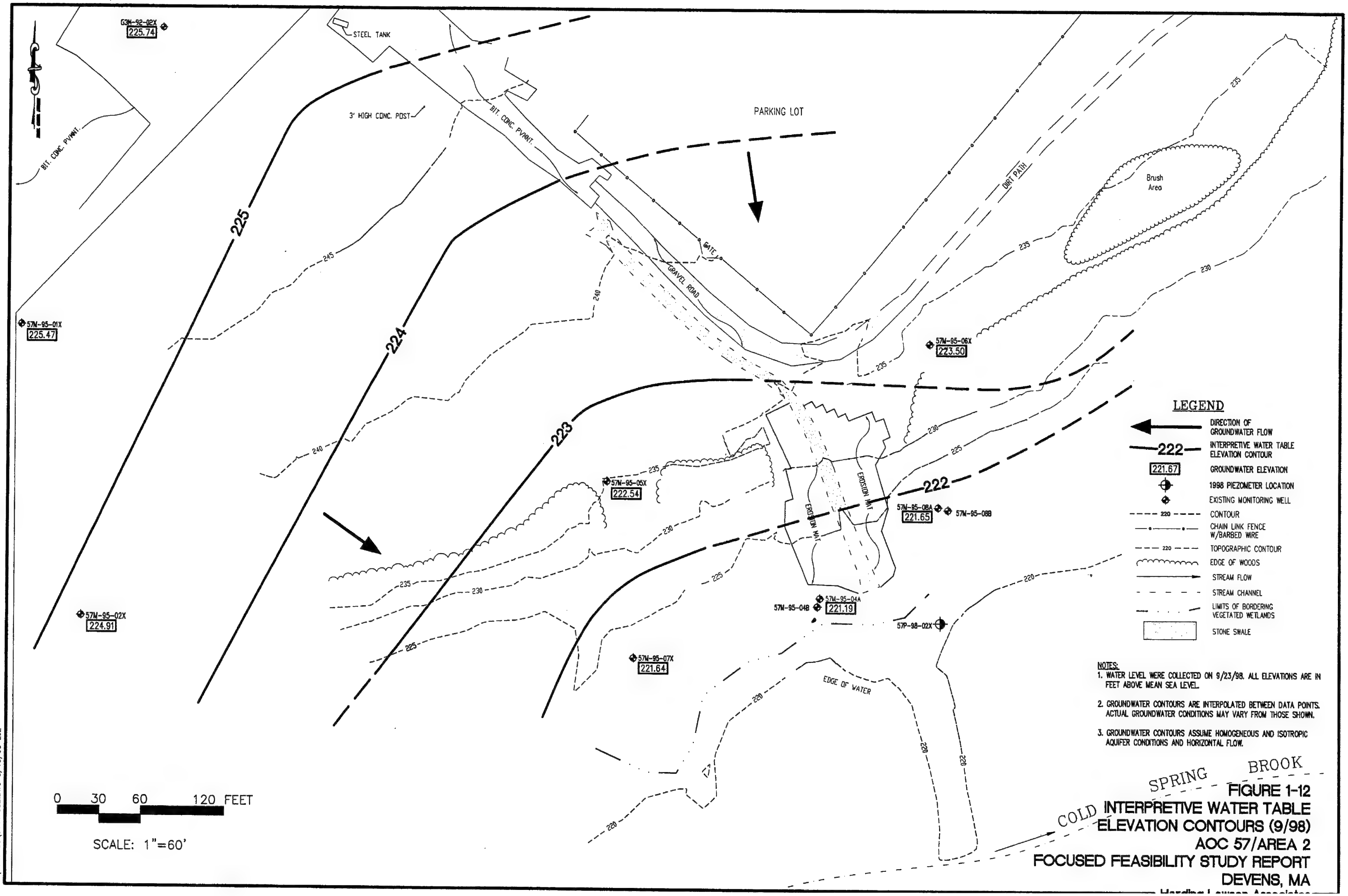
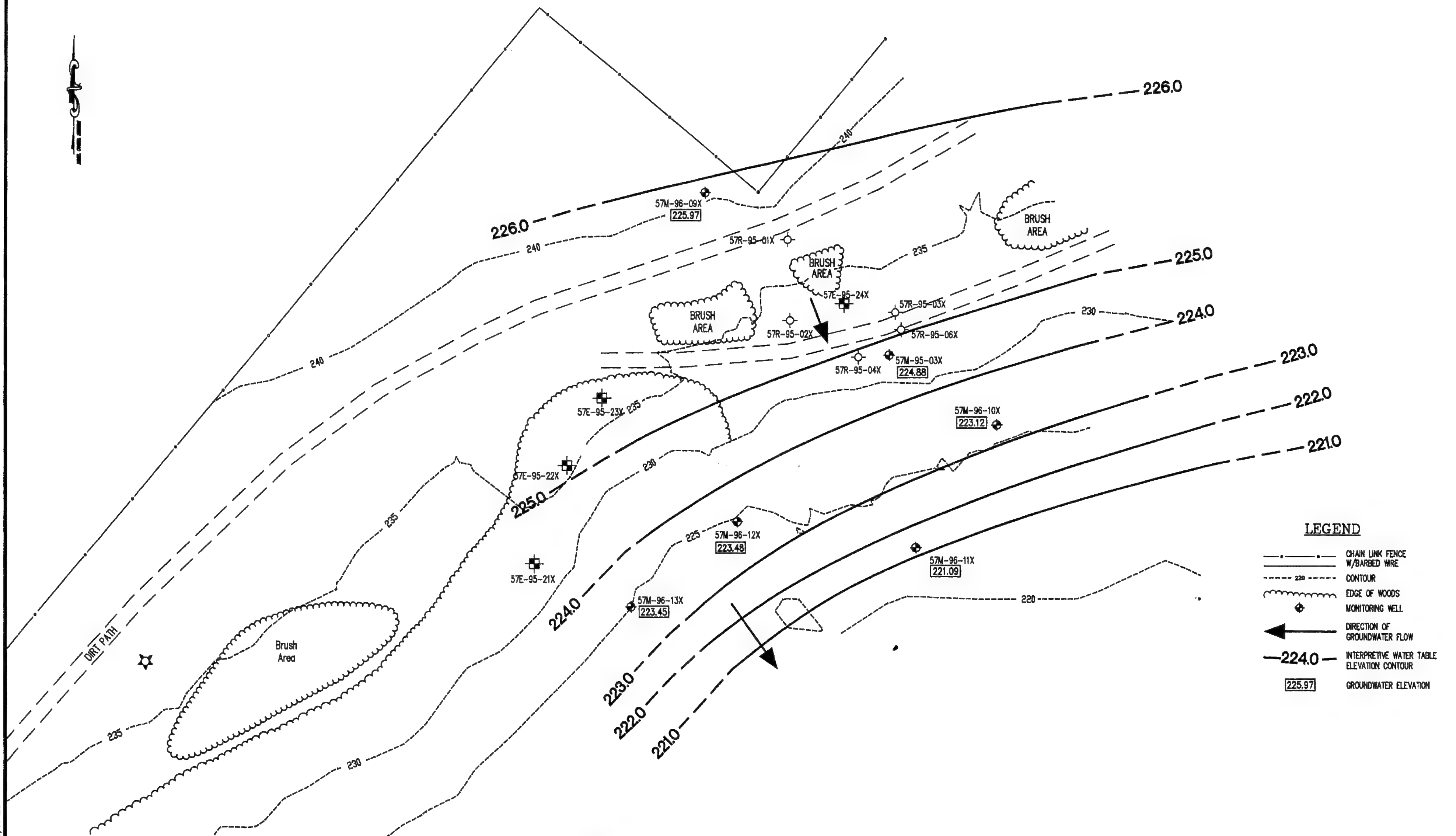


FIGURE 1-12
INTERPRETIVE WATER TABLE ELEVATION CONTOURS (9/98)
AOC 57/AREA 2
FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MA



NOTES:

1. WATER LEVELS WERE COLLECTED ON 1/15/97. ELEVATIONS ARE IN FEET ABOVE MEAN SEA LEVEL.
2. GROUNDWATER CONTOURS ARE INTERPOLATED BETWEEN DATA POINTS. ACTUAL GROUNDWATER CONDITIONS MAY VARY FROM THOSE SHOWN.
3. GROUNDWATER CONTOURS ASSUME HOMOGENEOUS AND ISOTROPIC AQUIFER CONDITIONS AND HORIZONTAL FLOW.

FIGURE 1-13
INTERPRETIVE WATER TABLE ELEVATION CONTOURS (1/97)
AOC 57/AREA 3
FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MA
Harding Lawson Associates

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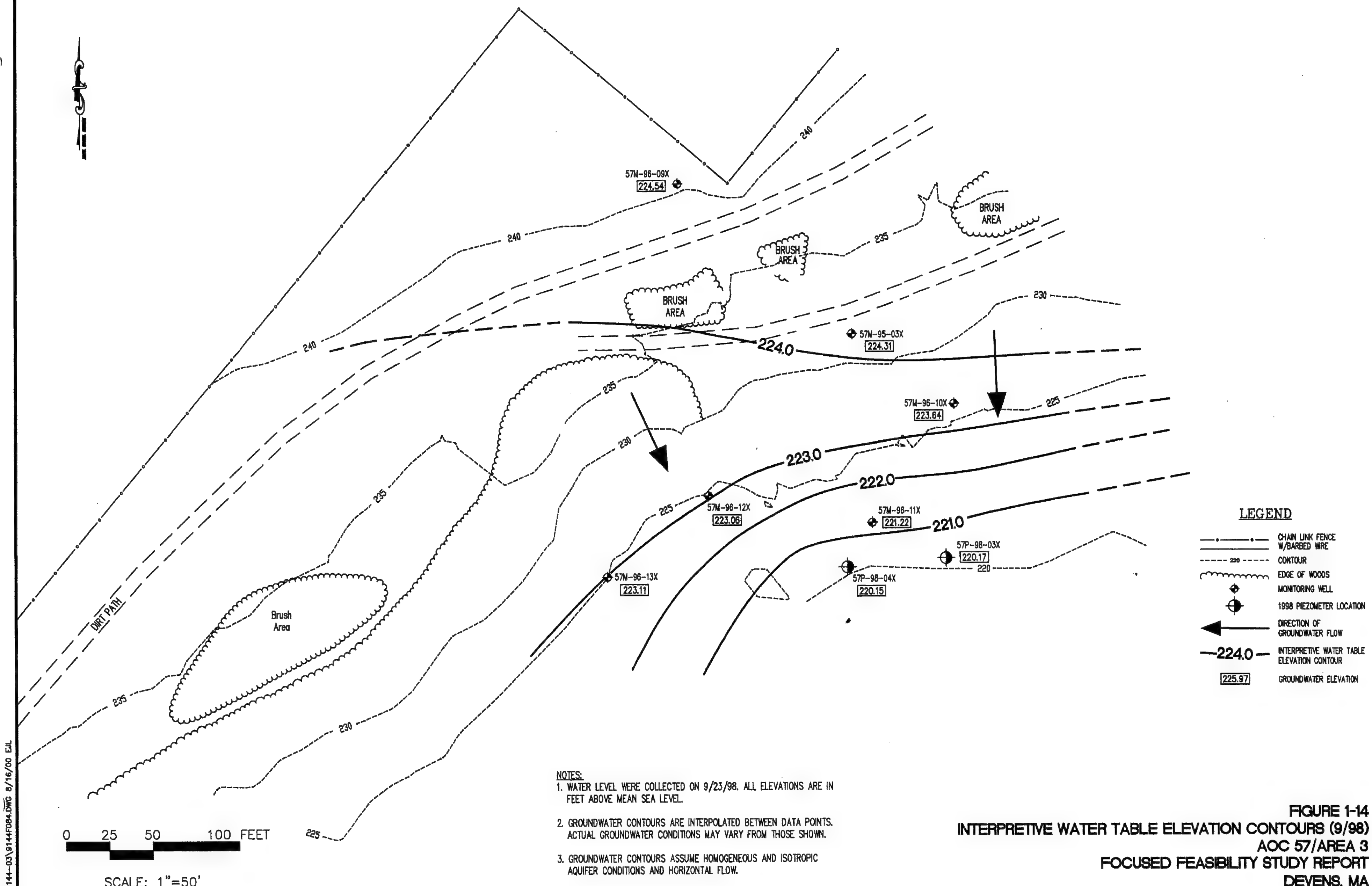

NOTES:

1. WATER LEVEL WERE COLLECTED ON 9/23/98. ALL ELEVATIONS ARE IN FEET ABOVE MEAN SEA LEVEL.
2. GROUNDWATER CONTOURS ARE INTERPOLATED BETWEEN DATA POINTS. ACTUAL GROUNDWATER CONDITIONS MAY VARY FROM THOSE SHOWN.
3. GROUNDWATER CONTOURS ASSUME HOMOGENEOUS AND ISOTROPIC AQUIFER CONDITIONS AND HORIZONTAL FLOW.

FIGURE 1-14
INTERPRETIVE WATER TABLE ELEVATION CONTOURS (9/98)
AOC 57/AREA 3
FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MA

Harding Lawson Associates

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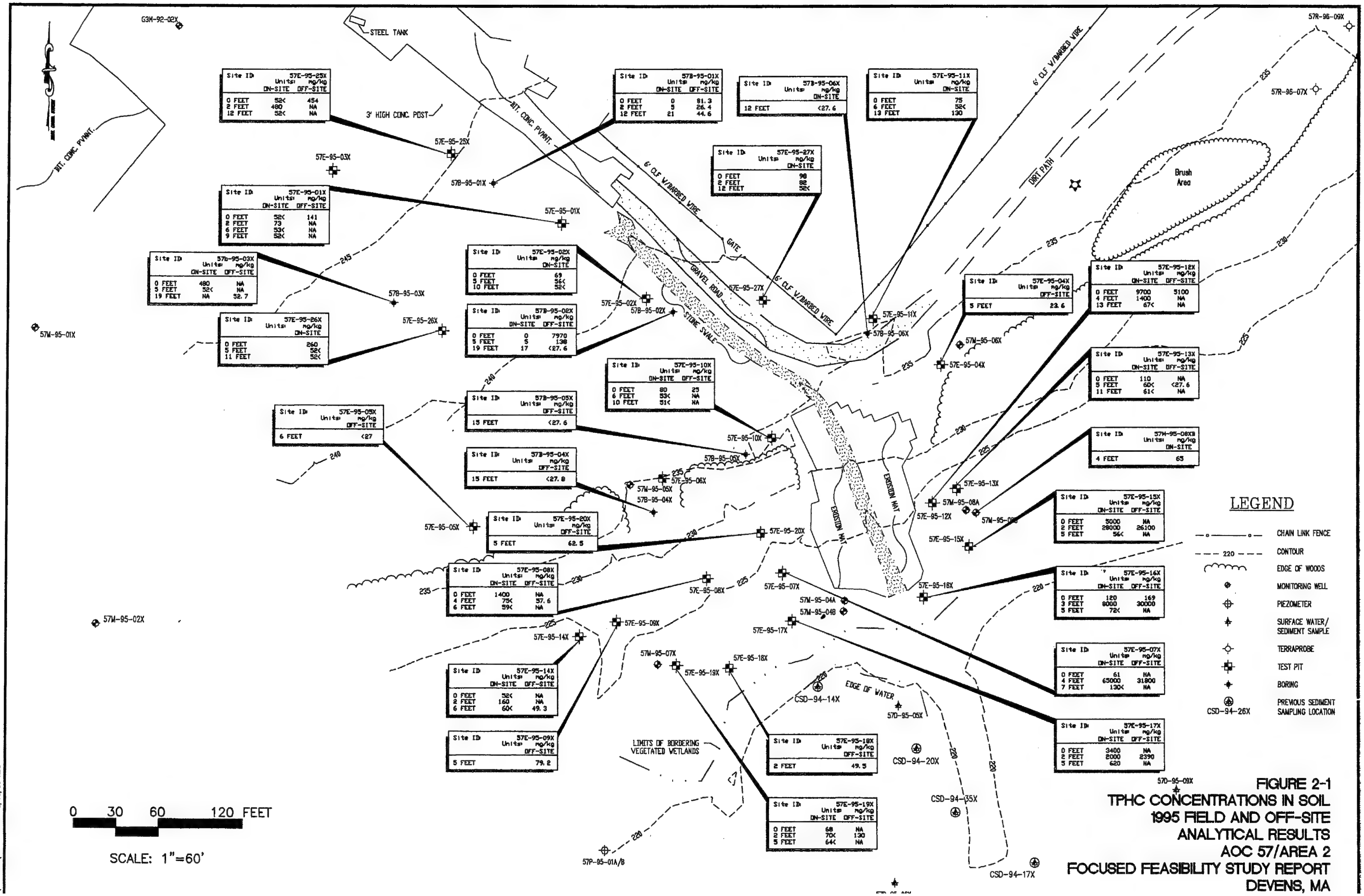

FIGURE 2-1
TPHC CONCENTRATIONS IN SOIL
1995 FIELD AND OFF-SITE
ANALYTICAL RESULTS
AOC 57/AREA 2
FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MA

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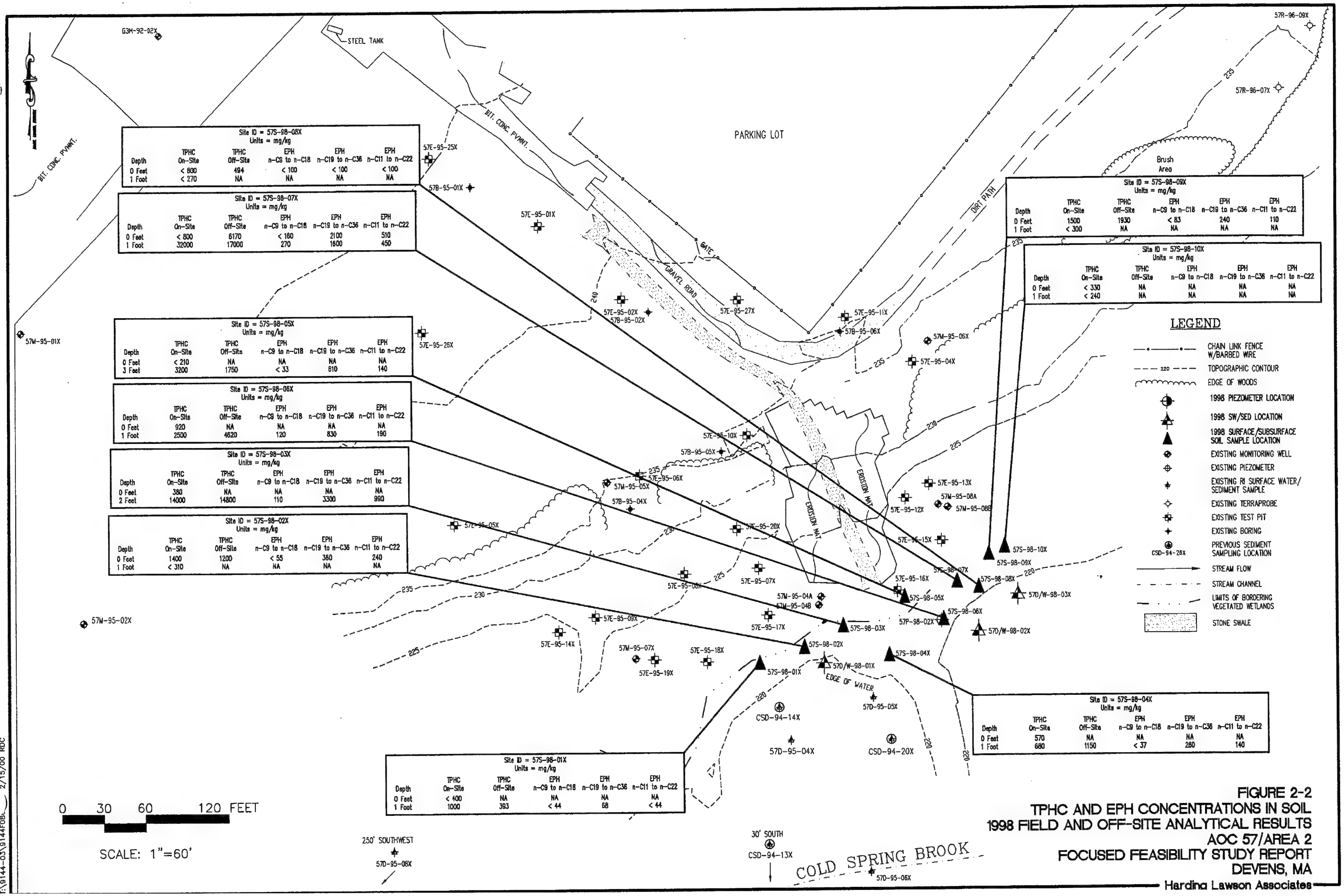

FIGURE 2-2
TPHC AND EPH CONCENTRATIONS IN SOIL
1998 FIELD AND OFF-SITE ANALYTICAL RESULTS
AOC 57/AREA 2
FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MA

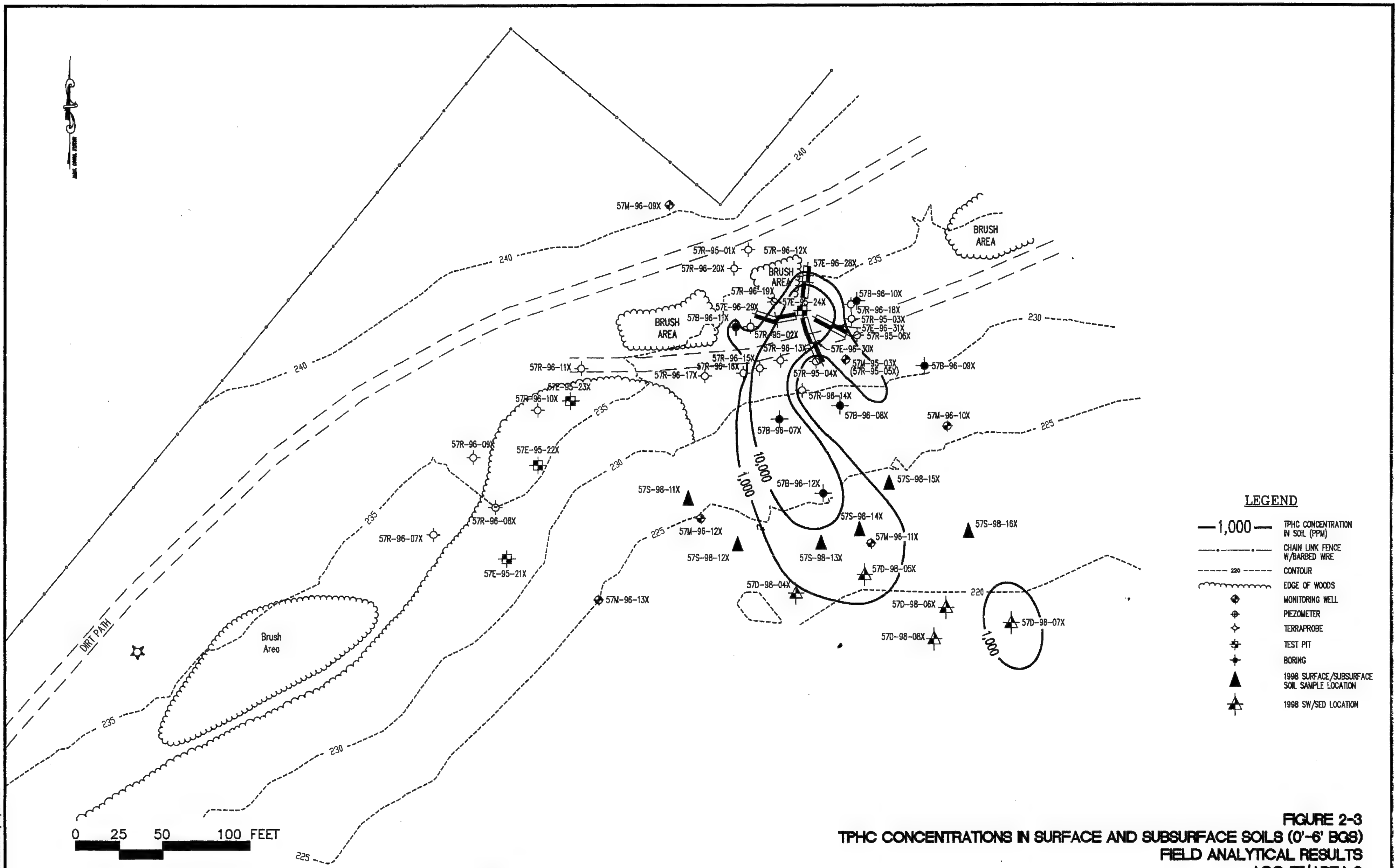

FIGURE 2-3
TPHC CONCENTRATIONS IN SURFACE AND SUBSURFACE SOILS (0'-6' BGS)
FIELD ANALYTICAL RESULTS
AOC 57/AREA 3
FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MA

NOTES:

1. CONTOURS ARE BASED ON FIELD ANALYTICAL RESULTS PRESENTED ON TABLES 7-10, 7-11 AND 7-13 OF THE RI TEXT.

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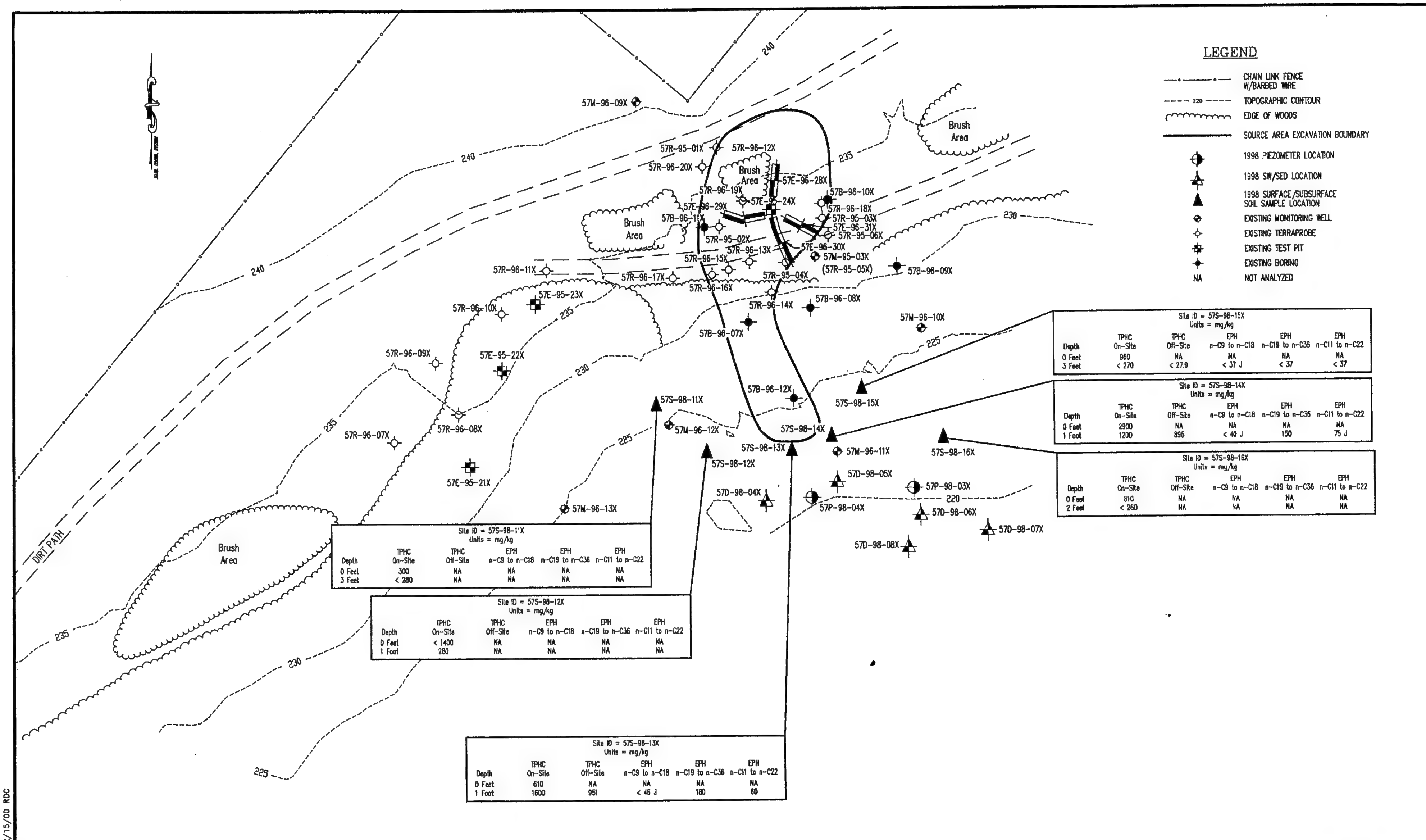

Site ID = 57S-98-15X
Units = mg/kg

Depth	TPHC On-Site	TPHC Off-Site	EPH n-C9 to n-C18	EPH n-C19 to n-C36	EPH n-C11 to n-C22
0 Feet	960	NA	NA	NA	NA
3 Feet	< 270	< 27.9	< 37 J	< 37	< 37

Site ID = 57S-98-14X
Units = mg/kg

Depth	TPHC On-Site	TPHC Off-Site	EPH n-C9 to n-C18	EPH n-C19 to n-C36	EPH n-C11 to n-C22
0 Feet	2900	NA	NA	NA	NA
1 Foot	1200	895	< 40 J	150	75 J

Site ID = 57S-98-16X
Units = mg/kg

Depth	TPHC On-Site	TPHC Off-Site	EPH n-C9 to n-C18	EPH n-C19 to n-C36	EPH n-C11 to n-C22
0 Feet	810	NA	NA	NA	NA
2 Feet	< 260	NA	NA	NA	NA

Site ID = 57S-98-11X
Units = mg/kg

Depth	TPHC On-Site	TPHC Off-Site	EPH n-C9 to n-C18	EPH n-C19 to n-C36	EPH n-C11 to n-C22
0 Feet	300	NA	NA	NA	NA
3 Feet	< 280	NA	NA	NA	NA

Site ID = 57S-98-12X
Units = mg/kg

Depth	TPHC On-Site	TPHC Off-Site	EPH n-C9 to n-C18	EPH n-C19 to n-C36	EPH n-C11 to n-C22
0 Feet	< 1400	NA	NA	NA	NA
1 Foot	280	NA	NA	NA	NA

Site ID = 57S-98-13X
Units = mg/kg

Depth	TPHC On-Site	TPHC Off-Site	EPH n-C9 to n-C18	EPH n-C19 to n-C36	EPH n-C11 to n-C22
0 Feet	610	NA	NA	NA	NA
1 Foot	1600	951	< 46 J	180	60

FIGURE 2-4
1998 TPHC AND EPH CONCENTRATIONS IN SOIL
AOC 57/AREA 3
FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MA

Harding Lawson Associates

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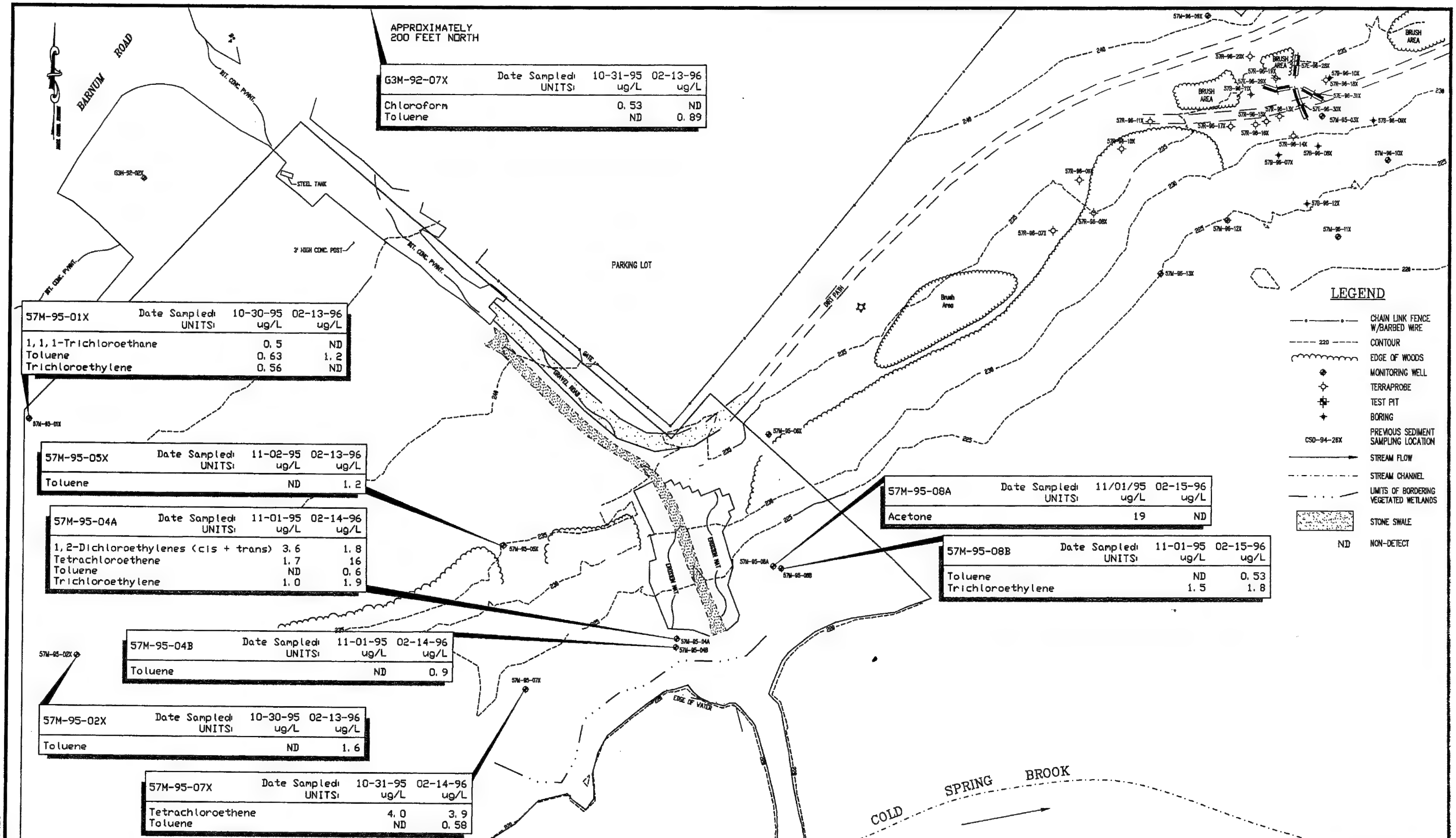


FIGURE 2-5
ROUND 1 AND ROUND 2 VOC DETECTIONS
IN OFF-SITE GROUNDWATER SAMPLES
AOC 57/AREA 2
FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MA

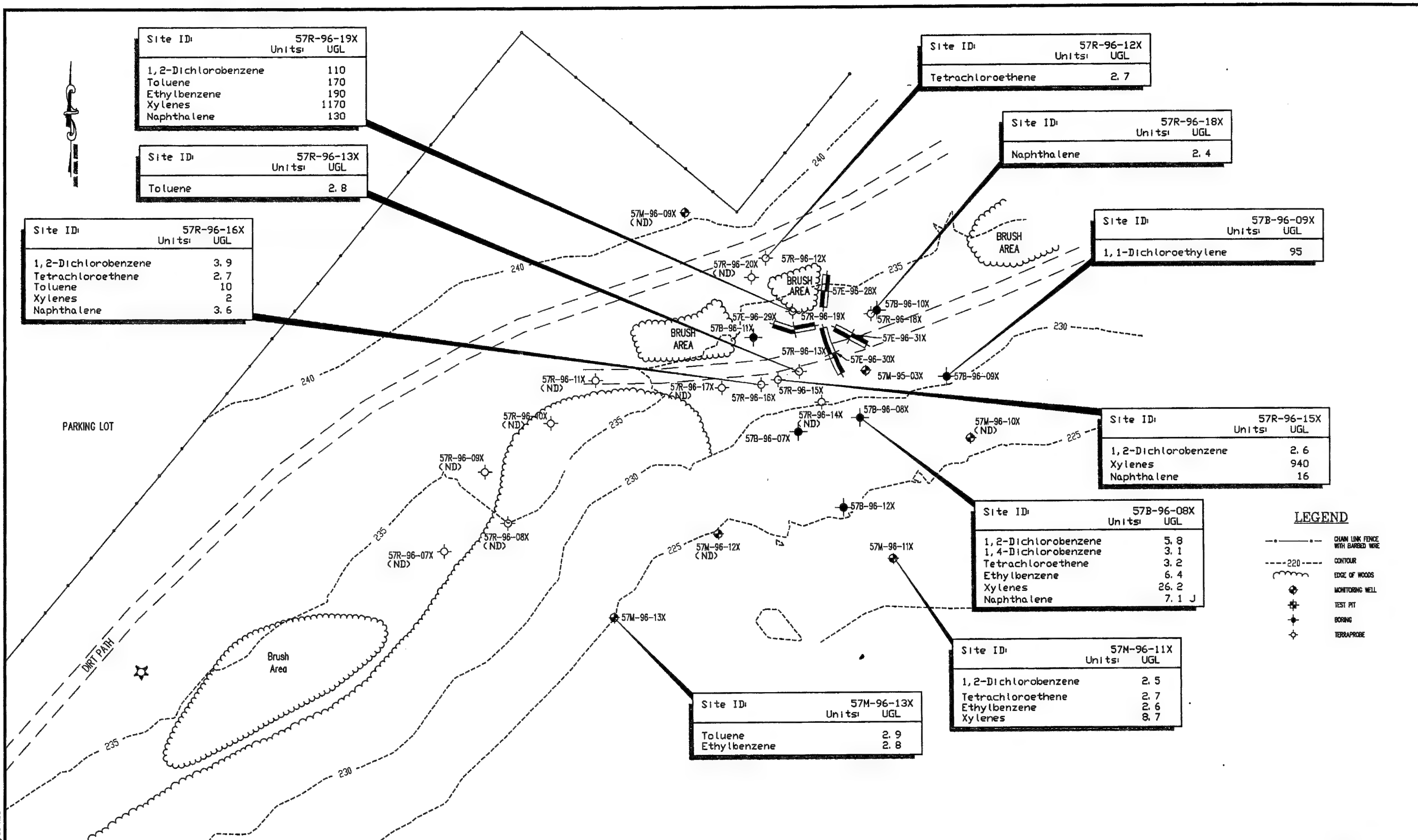
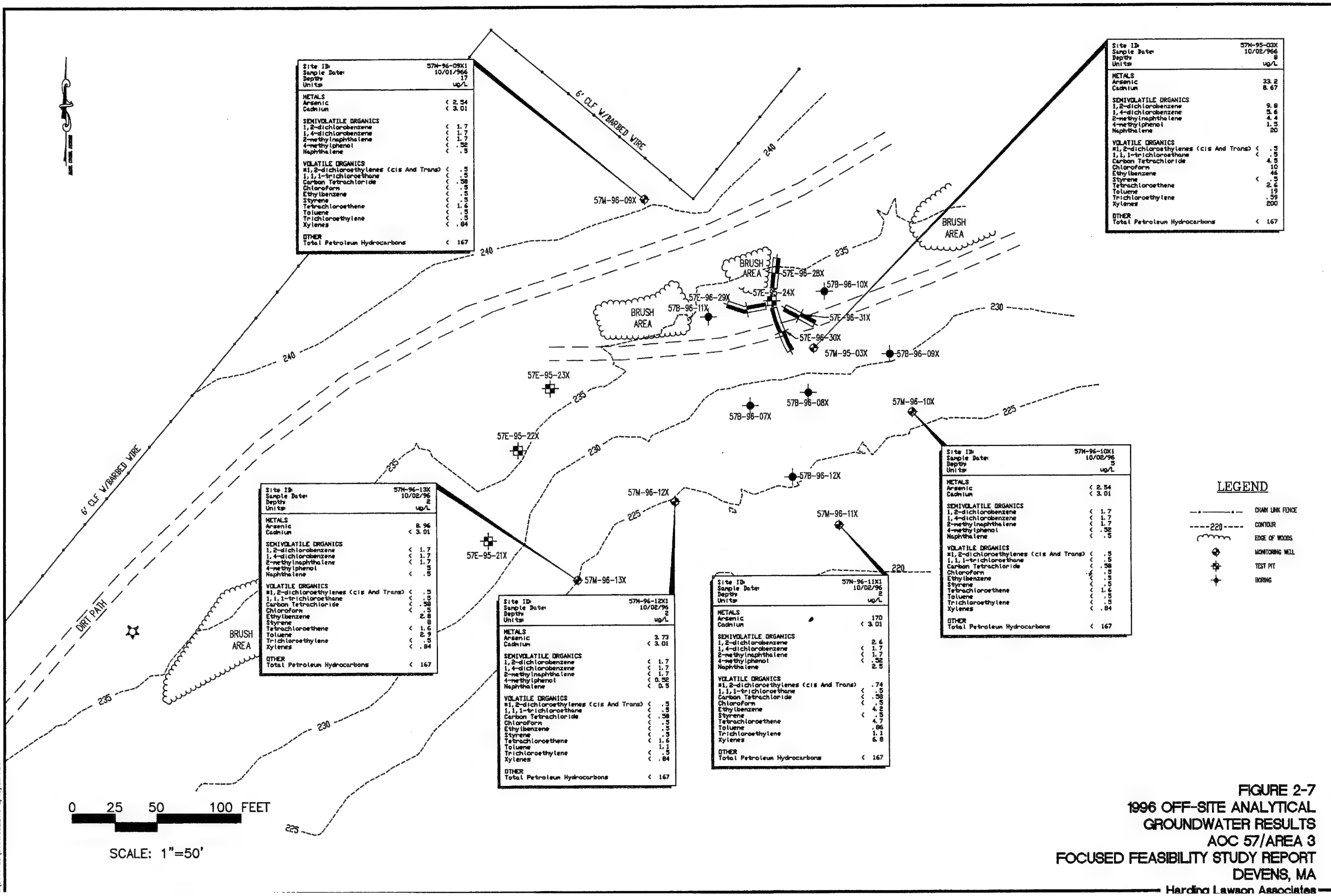


FIGURE 2-6
GROUNDWATER 1996 FIELD ANALYTICAL DETECTS
AOC 57/AREA 3
FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MA

Harding Lawson Associates



Site ID:	57M-96-09X1	57M-95-03X	57M-96-13X	57M-96-12X1	57M-96-11X1	57M-96-10X1
Sample Date:	10/01/966	10/02/966	10/02/96	10/02/96	10/02/96	10/02/96
Depth:	17	8	2	2	2	5
Units:	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
METALS						
Arsenic	< 2.54	33.2	8.96	3.73	170	< 2.54
Cadmium	< 3.01	8.67	< 3.01	< 3.01	< 3.01	< 3.01
SEMIVOLATILE ORGANICS						
1,2-dichlorobenzene	< 1.7	9.8	< 1.7	< 1.7	2.6	< 1.7
1,4-dichlorobenzene	< 1.7	5.6	< 1.7	< 1.7	< 1.7	< 1.7
2-methylnaphthalene	< 1.7	4.4	< 1.7	< 1.7	< 1.7	< 1.7
4-methylphenol	< .52	1.5	5	< 0.52	< .52	< .52
Naphthalene	< .5	20	< .5	< 0.5	2.5	< .5
VOLATILE ORGANICS						
*1,2-dichloroethylenes (cis And Trans)	< .5	< .5	< .5	< .5	.74	< .5
1,1,1-trichloroethane	< .5	< .5	< .5	< .5	< .5	< .5
Carbon Tetrachloride	< .58	4.5	< .58	< .58	< .58	< .58
Chloroform	< .5	10	< .5	< .5	< .5	< .5
Ethylbenzene	< .5	46	2.8	< .5	4.2	< .5
Styrene	< .5	< .5	8	< .5	< .5	< .5
Tetrachloroethene	< 1.6	2.6	< 1.6	< 1.6	4.7	< 1.6
Toluene	< .5	19	2.9	1.1	.86	< .5
Trichloroethylene	< .5	.59	< .5	< .5	1.1	< .5
Xylenes	< .84	200	< .84	< .84	6.8	< .84
OTHER						
Total Petroleum Hydrocarbons	< 167	< 167	< 167	< 167	< 167	< 167

FIGURE 2-7
1996 OFF-SITE ANALYTICAL
GROUNDWATER RESULTS
AOC 57/AREA 3
FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MA

Harding Lawson Associates

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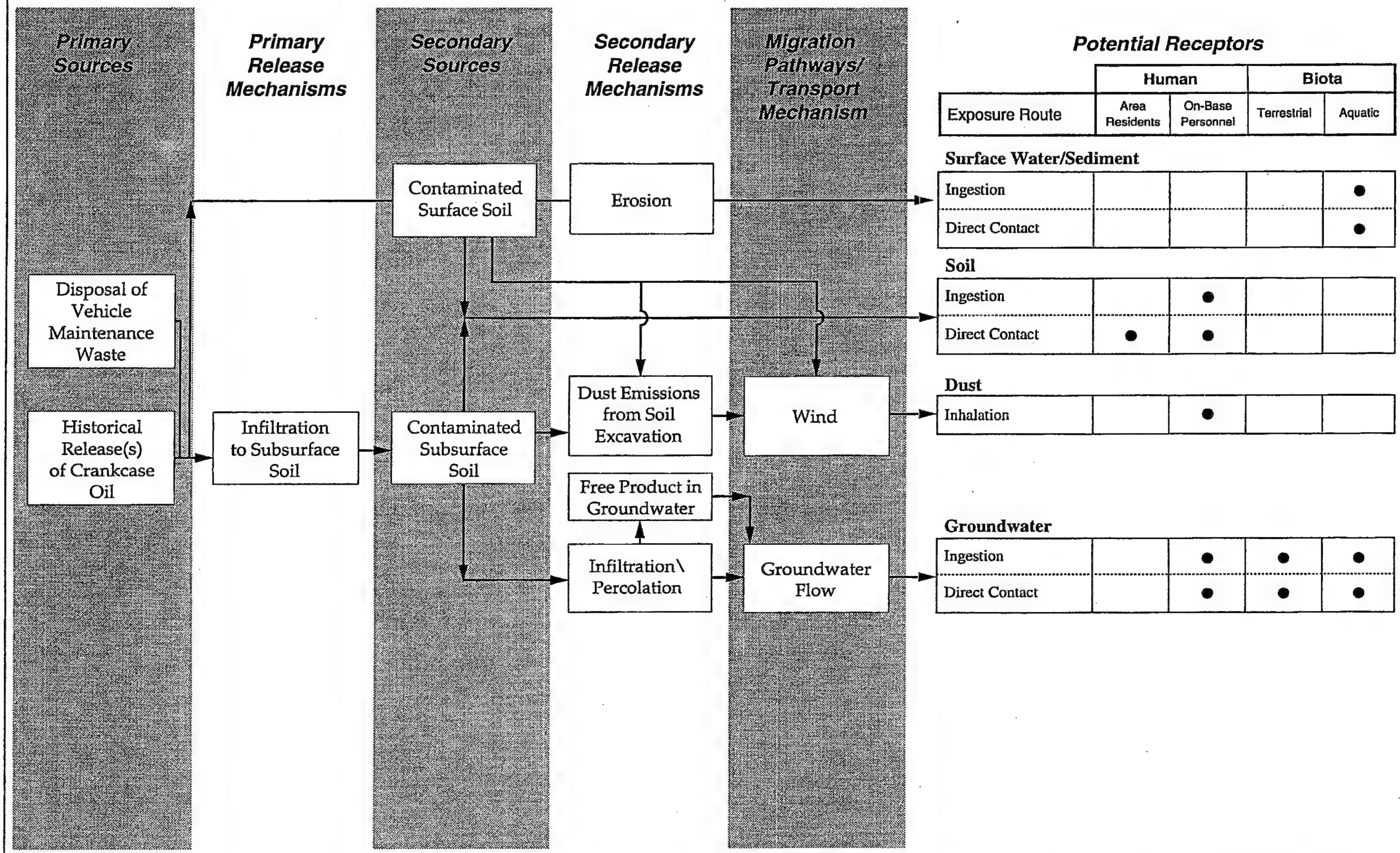

FIGURE 2-8
RI CONCEPTUAL MODEL FLOW DIAGRAM
AOC 57
FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MA

Harding Lawson Associates

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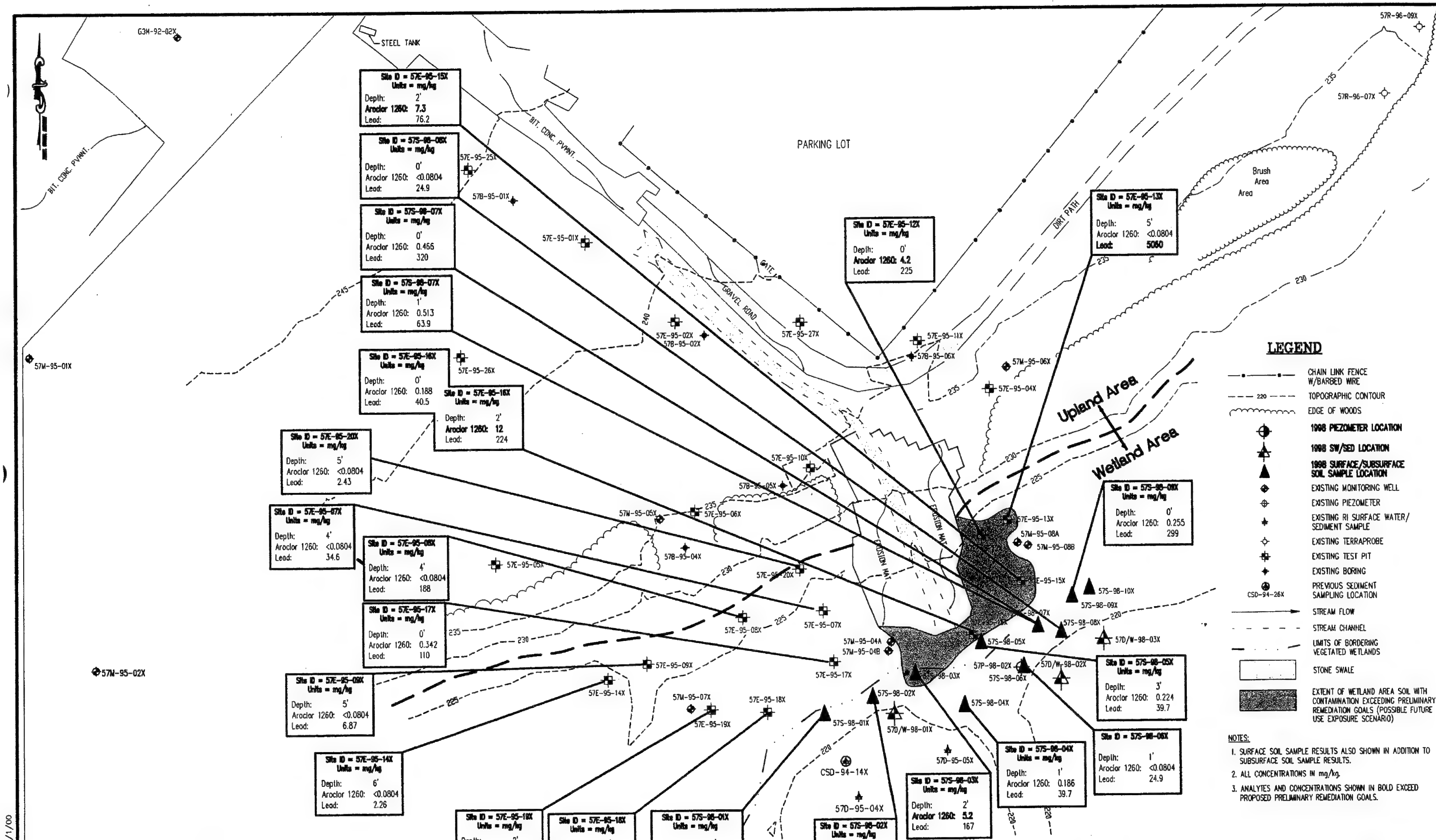

FIGURE 3-1
ESTIMATED EXTENT OF WETLAND SUBSURFACE SOIL CONTAMINATION POSSIBLE FUTURE USE (CONSTRUCTION WORKER)
AOC 57/AREA 2
FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MA

Harding Lawson Associates

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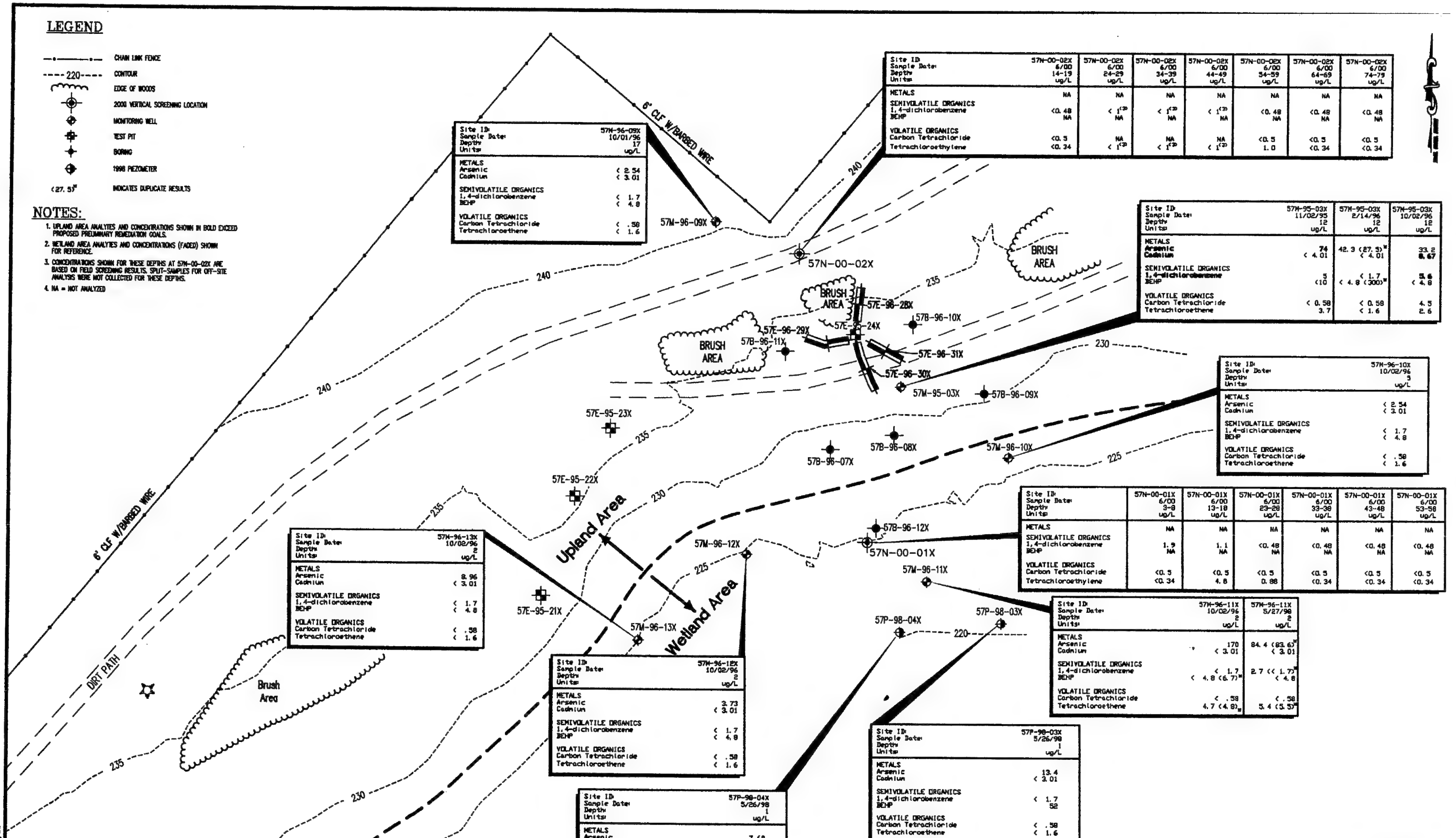

Site ID:	57N-00-02X	57N-00-02X	57N-00-02X	57N-00-02X	57N-00-02X	57N-00-02X	57N-00-02X
Sample Date:	6/00	6/00	6/00	6/00	6/00	6/00	6/00
Depth:	14-19	24-29	34-39	44-49	54-59	64-69	74-79
Units:	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
METALS	NA	NA	NA	NA	NA	NA	NA
SEMIVOLATILE ORGANICS							
1,4-dichlorobenzene	<0.48	< 1[(3)]	< 1[(3)]	< 1[(3)]	<0.48	<0.48	<0.48
BEHP	NA	NA	NA	NA	NA	NA	NA
VOLATILE ORGANICS							
Carbon Tetrachloride	<0.5	NA	NA	NA	<0.5	<0.5	<0.5
Tetrachloroethylene	<0.34	< 1[(3)]	< 1[(3)]	< 1[(3)]	1.0	<0.34	<0.34

Site ID:	57M-96-09X
Sample Date:	10/01/96
Depth:	17
Units:	ug/L
METALS	
Arsenic	< 2.54
Cadmium	< 3.01
SEMIVOLATILE ORGANICS	
1,4-dichlorobenzene	< 1.7
BEHP	< 4.8
VOLATILE ORGANICS	
Carbon Tetrachloride	< .58
Tetrachloroethene	< 1.6

Site ID:	57M-95-03X	57M-95-03X	57M-95-03X
Sample Date:	11/02/95	2/14/96	10/02/96
Depth:	12	12	12
Units:	ug/L	ug/L	ug/L
METALS			
Arsenic	74	42.3 (27.5)[D]	33.2
Cadmium	< 4.01	< 4.01	8.67
SEMIVOLATILE ORGANICS			
1,4-dichlorobenzene	5	< 1.7	5.6
BEHP	<10	< 4.8 (300)[D]	< 4.8
VOLATILE ORGANICS			
Carbon Tetrachloride	< 0.58	< 0.58	4.5
Tetrachloroethene	3.7	< 1.6	2.6

Site ID:	57M-96-10X
Sample Date:	10/02/96
Depth:	3
Units:	ug/L
METALS	
Arsenic	< 2.54
Cadmium	< 3.01
SEMIVOLATILE ORGANICS	
1,4-dichlorobenzene	< 1.7
BEHP	< 4.8
VOLATILE ORGANICS	
Carbon Tetrachloride	< .58
Tetrachloroethene	< 1.6

Site ID:	57N-00-01X	57N-00-01X	57N-00-01X	57N-00-01X	57N-00-01X	57N-00-01X
Sample Date:	6/00	6/00	6/00	6/00	6/00	6/00
Depth:	3-8	13-18	23-28	33-38	43-48	53-58
Units:	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
METALS	NA	NA	NA	NA	NA	NA
SEMIVOLATILE ORGANICS						
1,4-dichlorobenzene	1.9	1.1	<0.48	<0.48	<0.48	<0.48
BEHP	NA	NA	NA	NA	NA	NA
VOLATILE ORGANICS						
Carbon Tetrachloride	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Tetrachloroethylene	<0.34	4.8	0.88	<0.34	<0.34	<0.34

Site ID:	57M-96-13X
Sample Date:	10/02/96
Depth:	2
Units:	ug/L
METALS	
Arsenic	8.96
Cadmium	< 3.01
SEMIVOLATILE ORGANICS	
1,4-dichlorobenzene	< 1.7
BEHP	< 4.8
VOLATILE ORGANICS	
Carbon Tetrachloride	< .58
Tetrachloroethene	< 1.6

Site ID:	57M-96-11X	57M-96-11X
Sample Date:	10/02/96	5/27/98
Depth:	2	2
Units:	ug/L	ug/L
METALS		
Arsenic	170	84.4 (83.6)[D]
Cadmium	< 3.01	< 3.01
SEMIVOLATILE ORGANICS		
1,4-dichlorobenzene	< 1.7	2.7 (< 1.7)[D]
BEHP	< 4.8 (6.7)[D]	< 4.8
VOLATILE ORGANICS		
Carbon Tetrachloride	< .58	< .58
Tetrachloroethene	4.7 (4.8)[D]	5.4 (5.5)[D]

Site ID:	57M-96-12X
Sample Date:	10/02/96
Depth:	2
Units:	ug/L
METALS	
Arsenic	3.73
Cadmium	< 3.01
SEMIVOLATILE ORGANICS	
1,4-dichlorobenzene	< 1.7
BEHP	< 4.8
VOLATILE ORGANICS	
Carbon Tetrachloride	< .58
Tetrachloroethene	< 1.6

Site ID:	57P-98-03X
Sample Date:	5/26/98
Depth:	1
Units:	ug/L
METALS	
Arsenic	13.4
Cadmium	< 3.01
SEMIVOLATILE ORGANICS	
1,4-dichlorobenzene	< 1.7
BEHP	52
VOLATILE ORGANICS	
Carbon Tetrachloride	< .58
Tetrachloroethene	< 1.6

Site ID:	57P-98-04X
Sample Date:	5/26/98
Depth:	1
Units:	ug/L
METALS	
Arsenic	7.68
Cadmium	< 3.01
SEMIVOLATILE ORGANICS	
1,4-dichlorobenzene	< 1.7
BEHP	5.8
VOLATILE ORGANICS	
Carbon Tetrachloride	< .58
Tetrachloroethene	< 1.6

FIGURE 3-2
EXCEEDANCES OF PROPOSED PRGs IN UPLAND GROUNDWATER
POSSIBLE FUTURE USE (COMMERCIAL/INDUSTRIAL)
AOC 57/AREA 3
FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MA

Harding Lawson Associates

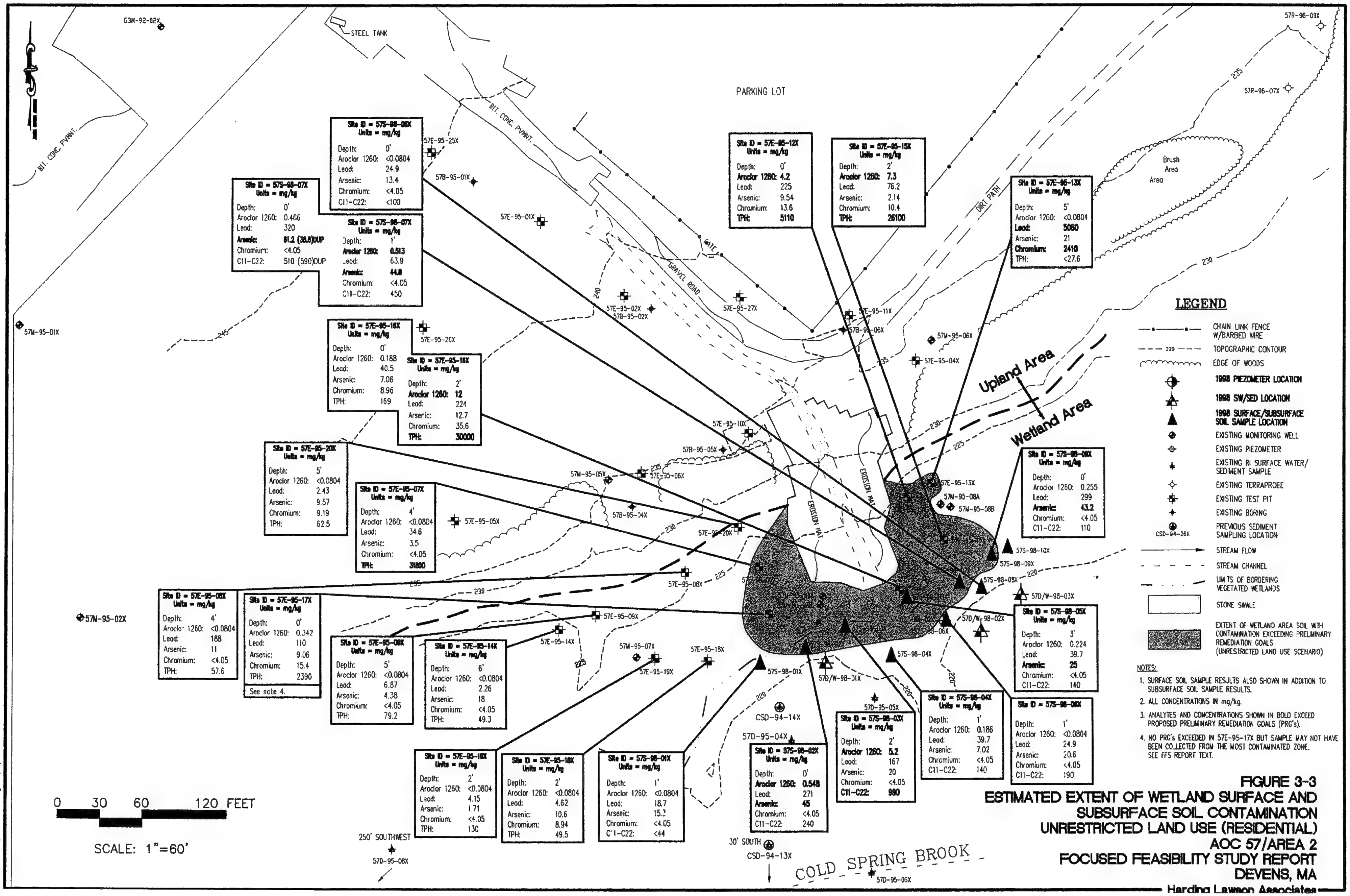

FIGURE 3-3
ESTIMATED EXTENT OF WETLAND SURFACE AND SUBSURFACE SOIL CONTAMINATION UNRESTRICTED LAND USE (RESIDENTIAL)
AOC 57/AREA 2
FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MA
Harding Lawson Associates

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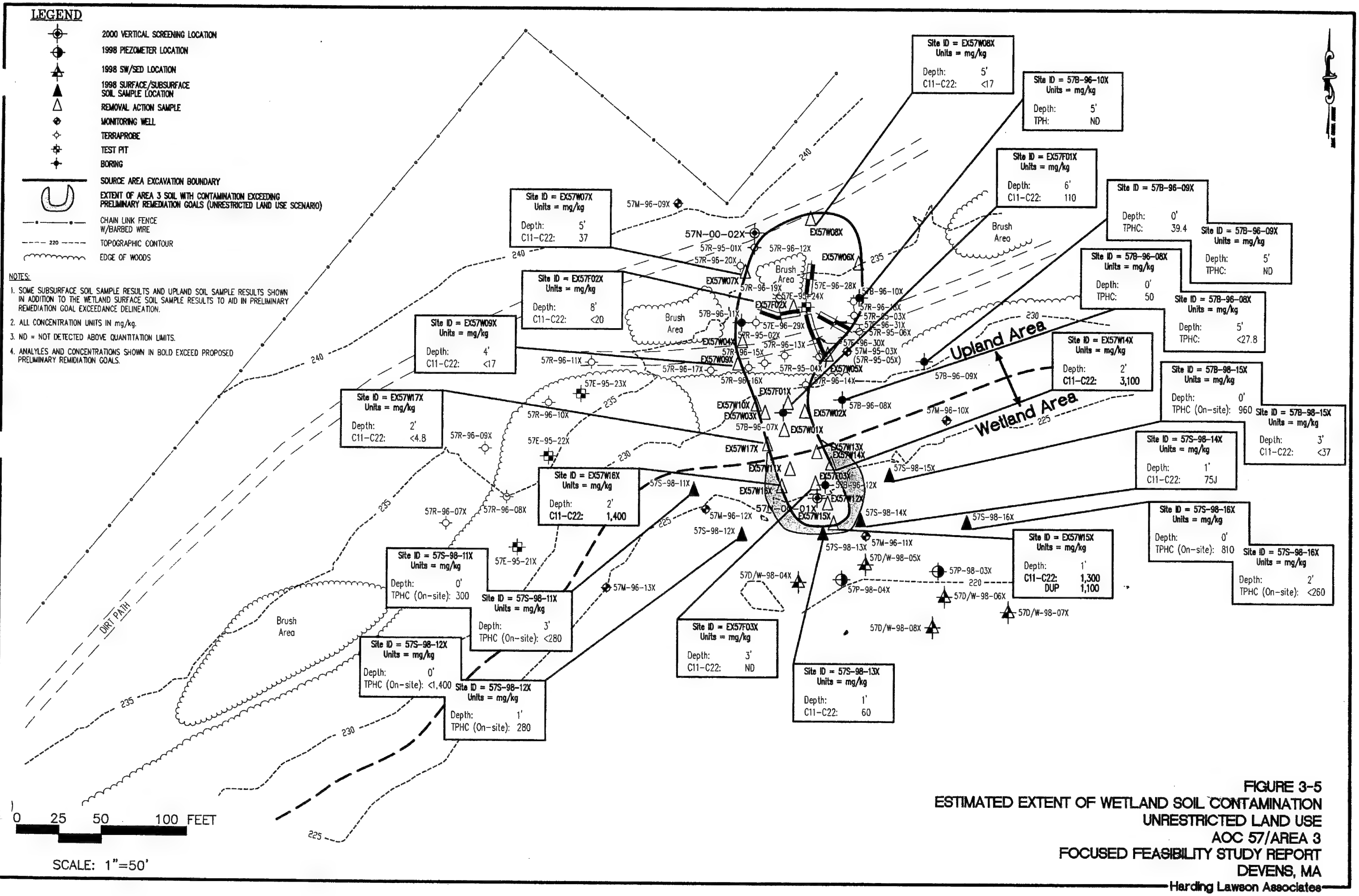
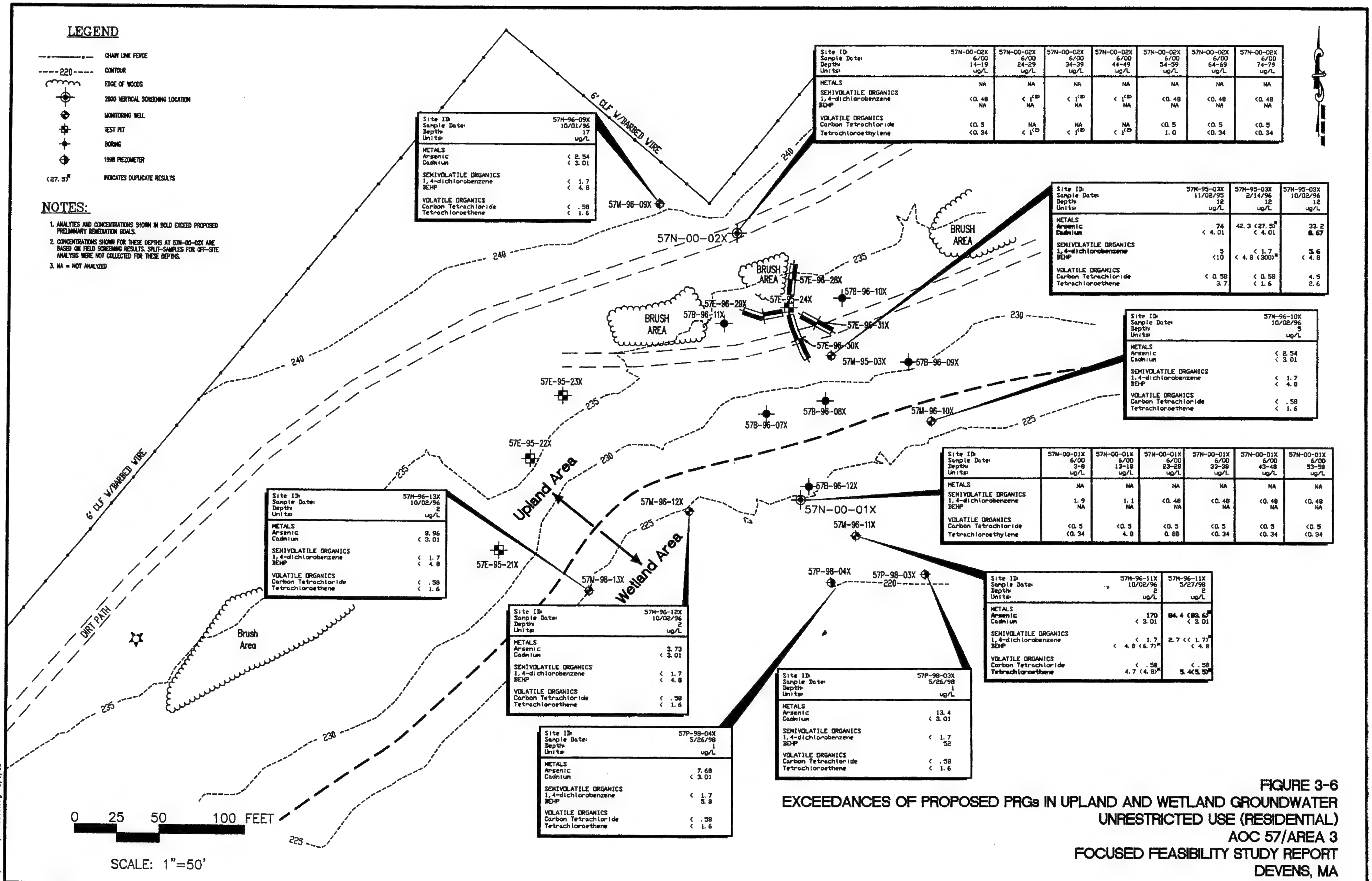


FIGURE 3-5
ESTIMATED EXTENT OF WETLAND SOIL CONTAMINATION
UNRESTRICTED LAND USE
AOC 57/AREA 3
FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MA
Harding Lawson Associates



Site ID: Sample Date: Depth: Units:	57N-00-02X 6/00 14-19 ug/L	57N-00-02X 6/00 24-29 ug/L	57N-00-02X 6/00 34-39 ug/L	57N-00-02X 6/00 44-49 ug/L	57N-00-02X 6/00 54-59 ug/L	57N-00-02X 6/00 64-69 ug/L	57N-00-02X 6/00 74-79 ug/L
METALS	NA	NA	NA	NA	NA	NA	NA
SEMIVOLATILE ORGANICS 1,4-dichlorobenzene	<0.48	< 1(2)	< 1(2)	< 1(2)	<0.48	<0.48	<0.48
BEHP	NA	NA	NA	NA	NA	NA	NA
VOLATILE ORGANICS Carbon Tetrachloride	<0.5	NA	NA	NA	<0.5	<0.5	<0.5
Tetrachloroethylene	<0.34	< 1(2)	< 1(2)	< 1(2)	1.0	<0.34	<0.34

Site ID: Sample Date: Depth: Units:	57M-96-09X 10/01/96 17 ug/L
METALS Arsenic	< 2.54
Cadmium	< 3.01
SEMIVOLATILE ORGANICS 1,4-dichlorobenzene	< 1.7
BEHP	< 4.8
VOLATILE ORGANICS Carbon Tetrachloride	< .58
Tetrachloroethene	< 1.6

Site ID: Sample Date: Depth: Units:	57M-95-03X 11/02/95 12 ug/L	57M-95-03X 2/14/96 12 ug/L	57M-95-03X 10/02/96 12 ug/L
METALS **Arsenic**	74	42.3 (27.5)*	33.2
Cadmium	< 4.01	< 4.01	**8.67**
SEMIVOLATILE ORGANICS **1,4-dichlorobenzene**	5	< 1.7	**5.6**
BEHP	<10	< 4.8 (300)*	< 4.8
VOLATILE ORGANICS Carbon Tetrachloride	< 0.58	< 0.58	4.5
Tetrachloroethene	3.7	< 1.6	2.6

Site ID: Sample Date: Depth: Units:	57M-96-10X 10/02/96 5 ug/L
METALS Arsenic	< 2.54
Cadmium	< 3.01
SEMIVOLATILE ORGANICS 1,4-dichlorobenzene	< 1.7
BEHP	< 4.8
VOLATILE ORGANICS Carbon Tetrachloride	< .58
Tetrachloroethene	< 1.6

Site ID: Sample Date: Depth: Units:	57N-00-01X 6/00 3-8 ug/L	57N-00-01X 6/00 13-18 ug/L	57N-00-01X 6/00 23-28 ug/L	57N-00-01X 6/00 33-38 ug/L	57N-00-01X 6/00 43-48 ug/L	57N-00-01X 6/00 53-58 ug/L
METALS	NA	NA	NA	NA	NA	NA
SEMIVOLATILE ORGANICS 1,4-dichlorobenzene	1.9	1.1	<0.48	<0.48	<0.48	<0.48
BEHP	NA	NA	NA	NA	NA	NA
VOLATILE ORGANICS Carbon Tetrachloride	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Tetrachloroethylene	<0.34	4.8	0.88	<0.34	<0.34	<0.34

Site ID: Sample Date: Depth: Units:	57M-96-13X 10/02/96 2 ug/L
METALS Arsenic	8.96
Cadmium	< 3.01
SEMIVOLATILE ORGANICS 1,4-dichlorobenzene	< 1.7
BEHP	< 4.8
VOLATILE ORGANICS Carbon Tetrachloride	< .58
Tetrachloroethene	< 1.6

Site ID: Sample Date: Depth: Units:	57M-96-12X 10/02/96 2 ug/L
METALS Arsenic	3.73
Cadmium	< 3.01
SEMIVOLATILE ORGANICS 1,4-dichlorobenzene	< 1.7
BEHP	< 4.8
VOLATILE ORGANICS Carbon Tetrachloride	< .58
Tetrachloroethene	< 1.6

Site ID: Sample Date: Depth: Units:	57M-96-11X 10/02/96 2 ug/L	57M-96-11X 5/27/98 2 ug/L
METALS **Arsenic**	170	**84.4 (83.6)***
Cadmium	< 3.01	< 3.01
SEMIVOLATILE ORGANICS 1,4-dichlorobenzene	< 1.7	2.7 (< 1.7)*
BEHP	< 4.8 (6.7)*	< 4.8
VOLATILE ORGANICS Carbon Tetrachloride	< .58	< .58
Tetrachloroethene	4.7 (4.8)*	**5.4 (5.5)***

Site ID: Sample Date: Depth: Units:	57P-98-03X 5/26/98 1 ug/L
METALS Arsenic	13.4
Cadmium	< 3.01
SEMIVOLATILE ORGANICS 1,4-dichlorobenzene	< 1.7
BEHP	52
VOLATILE ORGANICS Carbon Tetrachloride	< .58
Tetrachloroethene	< 1.6

Site ID: Sample Date: Depth: Units:	57P-98-04X 5/26/98 1 ug/L
METALS Arsenic	7.68
Cadmium	< 3.01
SEMIVOLATILE ORGANICS 1,4-dichlorobenzene	< 1.7
BEHP	5.8
VOLATILE ORGANICS Carbon Tetrachloride	< .58
Tetrachloroethene	< 1.6

FIGURE 3-6
EXCEEDANCES OF PROPOSED PRGs IN UPLAND AND WETLAND GROUNDWATER
UNRESTRICTED USE (RESIDENTIAL)
AOC 57/AREA 3
FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MA

Harding Lawson Associates

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TABLE 1-1
CRITERIA FOR EVALUATION OF ALTERNATIVES
AOC 57

FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MASSACHUSETTS

CRITERIA	DESCRIPTION
Overall protection of human health and environment	Describes how each alternative satisfies the remedial action objectives and protects human health and environment.
Compliance with ARARs	Describes how the alternative complies with ARARs, or if a waiver is required and how it is justified.
Long-term effectiveness and permanence	Evaluates the effectiveness in protecting human health and environment after response objectives have been met.
Reduction of toxicity, mobility, or volume through treatment	Evaluates the anticipated performance of the specific treatment technologies.
Short-term effectiveness	Examines the effectiveness of alternatives in protecting human health and environment during the construction and implementation period until response objectives are met.
Implementability	Assesses the technical and administrative feasibility of alternatives and the availability of required resources.
Cost	Evaluates the capital and operation and maintenance costs of each alternative.
State Acceptance*	Evaluates the technical and administrative issues and concerns the state may have.
Community Acceptance**	Evaluates the issues and concerns the public may have.

Notes:

* This criterion will be addressed once comments on the final feasibility study have been received.
** This criterion will be addressed when comments on the proposed plan have been received.

ARARs = Applicable or Relevant and Appropriate Requirements

TABLE 2-1
SUMMARY OF INVESTIGATION ACTIVITIES
AOC 57

FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MASSACHUSETTS

MONTH/ YEAR	ACTIVITY	CONTRACTOR	NUMBER COMPLETED	EXPLORATION/SAMPLE IDENTIFICATION	PURPOSE OF ACTIVITY
GROUPS 3, 5, AND 6 SITE INVESTIGATION (AREAS 1 AND 2)					
JUNE 1992	SURFACE WATER/SEDIMENT SAMPLING	ABB-ES	3 PAIRS	G3D-92-01X THRU G3D-92-03X	ASSESS WATER AND SEDIMENT QUALITY IN COLD SPRING BROOK
	MONITORING WELL INSTALLATION AND SAMPLING	ABB-ES	2 WELLS	G3M-92-02X AND G3M-92-07X	EVALUATE IMPACT OF GROUP 3 SAs ON GROUNDWATER QUALITY
GROUPS 2 + 7 SITE INVESTIGATION					
AUG 1992	SURFACE SOIL SAMPLING	ABB-ES	6 SAMPLES	57S-92-01X THRU 57S-92-03X (AREA 1) 57S-92-06X THRU 57S-92-08X (AREA 2)	ASSESS DISTRIBUTION OF CONTAMINANTS ALONG AREAS 1 AND 2 DRAINAGE DITCHES
	SURFACE WATER AND SEDIMENT SAMPLING	ABB-ES	2 PAIRS	57D-95-01X AND 57D-92-02X	ASSESS IMPACT OF SA 57 CONTAMINANTS ON COLD SPRING BROOK
CONCLUSIONS AND RECOMMENDATIONS: BASED UPON THE ABOVE INVESTIGATIONS AREA 1 WAS RECOMMENDED FOR INCLUSION IN THE AREE 70 STORM WATER STUDY. A SOIL REMOVAL ACTION FOCUSED ON TPHC WAS RECOMMENDED FOR AREA 2. RISK EVALUATIONS INDICATED THAT CHEMICAL HAZARDS WERE INSIGNIFICANT AT BOTH AREAS.					
AREE 70 EVALUATION					
AUG 1993	SURFACE WATER AND SEDIMENT SAMPLING	ADL	2 PAIRS 1 SEDIMENT	SSD/SSW-93-06A, SSD/SSW-93-06B SSD-93-06C	ASSESS CONTAMINANT DISTRIBUTION IN THE STORM SEWER SYSTEM NEAR SA 57 AREA 1
ADDENDUM 1 - AREE 70 RIVER EVALUATION					
SEPT 1993	SURFACE WATER AND SEDIMENT SAMPLING	ADL	3 PAIRS	SSD/SSW-93-92D,SSD/SSW-93-92E SSD/SSW-93-92G	ASSESS CONTAMINANT DISTRIBUTION IN COLD SPRING BROOK NEAR SA 57 AREA 1 AND AREA 2
CONCLUSIONS AND RECOMMENDATIONS: THE AREE 70 INVESTIGATION CONCLUDED THAT ADDITIONAL SAMPLING WAS REQUIRED FROM WITHIN COLD SPRING BROOK BASED UPON ELEVATED LEVELS OF METALS AND TPHC. FURTHER SAMPLING WAS PERFORMED AS PART OF THE LOWER COLD SPRING BROOK SI.					
LOWER COLD SPRING BROOK SITE INVESTIGATION					
SEPT 1994	SURFACE WATER AND SEDIMENT SAMPLING	ABB-ES	30 SW/SED PAIRS, 4 SED SAMPLES	CSW/CSD-94-01X THRU CSW/CSD-94-14X, CSW/CSD-94-16X THRU CSW/CSD-94-21X, CSD-94-22X, CSD-94-23X, CSW/CSD-94-24X, CSD-94-25X, CSW/CSD-94-26X THRU CSW/CSD-94-28X, CSD-94-29X, CSW/CSD-94-30X THRU CSW/CSD-94-35X	FURTHER CHARACTERIZE THE DISTRIBUTION OF CONTAMINANTS ASSOCIATED WITH BOTH STORM DRAIN SYTEM AND NON-POINT SOURCE RELEASES.
AUG 1995	ECOLOGICAL CHARACTERIZATION	ABB-ES	N/A	COLD SPRING BROOK WETLANDS	DETERMINE WHETHER OBSERVED VEGETATIVE IMPACTS WERE ASSOCIATED WITH DITCH CONTAMINATION
CONCLUSIONS AND RECOMMENDATIONS: THE LOWER COLD SPRING BROOK SI FOUND THAT MARSH SEDIMENTS IN THE VICINITY OF AREA 2 CONTAINED ELEVATED LEVELS OF PESTICIDES, VOCs, PAHs, AND INORGANICS. IT WAS RECOMMENDED THAT THIS AREA OF THE BROOK BE FURTHER EVALUATED DURING THE AOC 57 RI. NO FURTHER INVESTIGATION OR ACTION WAS RECOMMENDED FOR THE AREA DOWNSTREAM OF THE AREA 1 OUTFALL. IT WAS DECIDED TO PERFORM A REMOVAL ACTION AT THE AREA 1 OUTFALL TO ADDRESS CONTAMINATION RESULTING FROM RELEASES OF PETROLEUM TO THE OUTFALL.					

TABLE 2-1
SUMMARY OF INVESTIGATION ACTIVITIES
AOC 57

FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MASSACHUSETTS

MONTH/ YEAR	ACTIVITY	CONTRACTOR	NUMBER COMPLETED	EXPLORATION/SAMPLE IDENTIFICATION	PURPOSE OF ACTIVITY
AREA 1 CONTAMINATED SOIL REMOVAL					
FEB AND MARCH 1997	CONFIRMATORY SOIL SAMPLING PHASE I AND II	WESTON	9 SAMPLES	AOC57-A1-SW1; SW2; SW3; SW4; FL1; AND DUP. AOC57-A1-SW1/B; SW2/B; AND SW4/B	REMOVE PETROLEUM CONTAMINATED SOIL FROM AREA 1 OUTFALL
CONCLUSIONS AND RECOMMENDATIONS: CONFIRMATORY SAMPLING SHOWED THAT PETROLEUM CONTAMINATION AT THE OUTFALL WAS SUCCESSFULLY REMOVED, AND THAT REMAINING CONCENTRATIONS ARE CONSISTENT WITH OTHER OUTFALLS AND ARE THEREFORE LIKELY RELATED TO RUNOFF FROM PAVED AREAS ALONG BARNUM ROAD					
AREA 2 SUPPLEMENTAL SAMPLING / ACTION MEMORANDUM					
OCT 1993	SURFACE SOIL SAMPLING	ABB-ES	8 SAMPLES	57S-93-10X THRU 57S-93-17X	DELINEATE EXTENT OF SURFICIAL CONTAMINATION IN AREA 2 DRAINAGE DITCH
AREA 2 CONTAMINATED SOIL REMOVAL					
AUG AND SEPT 1994	DISCRETE SOIL SAMPLING	OHM	EXCAVATION SOIL SAMPLES	T1 THRU T6, B1THRU B8, B30, B32 THRU B35, B38, B39, B41 THRU B45, W31, W35A, W39 THRU W42, W48, W49, W54 THRU W70	MONITOR AND DIRECT SOIL REMOVAL ACTIVITIES
	TEST PITTING	OHM	20 TEST PITS	TP1 THRU TP5, T3 THRU T17, AND H1B1	ASSESS THE EXTENT OF TPHC CONTAMINATION
	SOIL AND PRODUCT SAMPLING	OHM	4 SOIL SAMPLES 2 PRODUCT SAMPLES	SBSA571 THRU SBSA573, SBSA57CH1 LSSA571, AND LSSA5702	CHARACTERIZATION OF CONTAMINANTS AND TPHC FINGERPRINTING
CONCLUSIONS AND RECOMMENDATIONS: THE EXCAVATION SHOWED THAT SOIL CONTAMINATION EXTENDED BEYOND THE ORIGINAL ESTIMATES. IT WAS RECOMMENDED THAT AN RI BE PERFORMED TO BETTER CHARACTERIZE THE LIMITS OF CONTAMINATION.					
AOC 57 REMEDIAL INVESTIGATION (AREA 2)					
SEPT 1995	GEOPHYSICAL SURVEY	ABB-ES	1 SURVEY	AOC 57 TO BARNUM ROAD AND FLOOD PLAIN	PERFORM TERRAIN CONDUCTIVITY (EM-31) AND MAGNETOMETER SURVEY TO LOCATE SUBSURFACE SOURCES OF TPHC CONTAMINATION AT AREA 2

TABLE 2-1
SUMMARY OF INVESTIGATION ACTIVITIES
AOC 57

FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MASSACHUSETTS

MONTH/ YEAR	ACTIVITY	CONTRACTOR	NUMBER COMPLETED	EXPLORATION/SAMPLE IDENTIFICATION	PURPOSE OF ACTIVITY
AOC 57 REMEDIAL INVESTIGATION (AREA 2) CONT.					
SEPT 1995	SURFACE WATER AND SEDIMENT SAMPLING	ABB-ES	8 SW/SED PAIRS 5 SED SAMPLES	57D-95-03X THRU 57D-95-10X	CHARACTERIZE THE NATURE OF CONTAMINANT MIGRATION TO COLD SPRING BROOK AT AREA 2
SEPT 1995	QUALITATIVE ECOLOGICAL SURVEY AND WETLANDS INVESTIGATION	ABB-ES	1 SURVEY	COLD SPRING BROOK WETLANDS AND FLOODPLAIN NEAR AREA 2	IDENTIFY POTENTIAL ECOLOGICAL RECEPTORS AND EXPOSURE PATHWAYS IN COLD SPRING BROOK
SEPT 1995	TEST PITTING	ABB-ES	27 TEST PITS	57E-95-01X THRU 57E-95-27X	ASSESS THE DISTRIBUTION OF CONTAMINANTS IN SOIL AND IDENTIFY POTENTIAL CONTAMINANT SOURCES AT AREA 2
SEPT AND OCT 1995	SOIL BORINGS	ABB-ES	6 SOIL BORINGS	57B-95-01X THRU 57B-95-06X	COLLECT OFF-SITE SOIL SAMPLES TO SUPPORT THE CONTAMINATION ASSESSMENT IN THE RI AND THE REMEDIAL ALTERNATIVE SCREENING IN THE FS
SEPT AND OCT 1995	MONITORING WELL INSTALLATION	ABB-ES	10 WELLS	57M-95-01X THRU 57M-95-03X, 57M-95-04A, 57M-95-04B, 57M-95-05X THRU 57M-95-07X, 57M-95-08A, 57M-95-08B	EVALUATE AND MONITOR GROUND WATER QUALITY IN THE VICINTY OF AOC 57 AREA 2
SEPT AND OCT 1995	PIEZOMETER INSTALLATION	ABB-ES	2 PIEZOS	57P-95-01A AND 57P-95-01B	EVALUATE HYDROLOGIC AND HYDROGEOLOGIC CONDITIONS IN THE AREA OF COLD SPRING BROOK
OCT 1995	TERRAPROBE BORINGS	ABB-ES	6 POINTS	57R-95-01X THRU 57R-95-06X	COLLECT SOIL AND GROUNDWATER SAMPLES FOR FIELD ANALYSIS TO DELINEATE EXTENT OF CONTAMINATION EAST OF AOC 57 (AREA 3)
OCT AND NOV 1995	GROUNDWATER SAMPLING ROUND 1	ABB-ES	12 WELLS	57M-95-01X THRU 57M-95-08B, G3M-92-02X AND G3M-92-07X	MONITOR GROUND WATER QUALITY AT AOC 57 AREA 2

TABLE 2-1
SUMMARY OF INVESTIGATION ACTIVITIES
AOC 57

FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MASSACHUSETTS

MONTH/ YEAR	ACTIVITY	CONTRACTOR	NUMBER COMPLETED	EXPLORATION/SAMPLE IDENTIFICATION	PURPOSE OF ACTIVITY
NOV 1995	IN-SITU HYDRAULIC CONDUCTIVITY TESTING	ABB-ES	10 WELLS	57M-95-01X THRU 57M-95-08B	PERMEABILITY TESTING TO ESTIMATE HYDRAULIC CONDUCTIVITIES OF THE OVERBURDEN AQUIFER
FEB 1996	GROUNDWATER SAMPLING ROUND 2	ABB-ES	12 WELLS	57M-95-01X THRU 57M-95-08B, G3M-92-02X AND G3M-92-07X	MONITOR GROUND WATER QUALITY AT AOC 57 AREA 2
CONCLUSIONS AND RECOMMENDATIONS: THE 1995 RI EFFORT REVEALED ADDITIONAL CONTAMINATION AT AN AREA (DESIGNATED AREA 3) APPROXIMATELY 600 FEET NORTHEAST OF AREA 2. FURTHER CHARACTERIZATION OF THIS AREA WAS RECOMMENDED.					
AOC 57 REMEDIAL INVESTIGATION MOD 1 (AREA 3)					
AUG 1996	GEOPHYSICAL SURVEY	ABB-ES	1 SURVEY	AOC 57 AREA 3	PERFORM TERRAIN CONDUCTIVITY (EM-31) AND EM-61 IN AN ATTEMPT TO DELINEATE POTENTIAL SOURCE(S) OF THE TPHC CONTAMINATION DETECTED IN THE VICINTY OF TEST PIT 57E-95-24X (AREA 3)
AUG 1996	TEST PITTING	ABB-ES	4 TEST PITS	57E-96-28X THRU 57E-96-31X	ASSESS THE DISTRIBUTION OF CONTAMINANTS IN SOIL AND DELINEATE POTENTIAL CONTAMINANT SOURCES AT AREA 3
AUG 1996	TERRAPROBE BORINGS	ABB-ES	14 POINTS	57R-96-07X THRU 57R-96-20X	COLLECT SOIL AND GROUNDWATER SAMPLES FOR FIELD ANALYSIS TO DELINEATE EXTENT OF CONTAMINATION AT AREA 3
AUG 1996	SOIL BORINGS	ABB-ES	6 BORINGS	57B-96-07X THRU 57B-96-12X	COLLECT SUBSURFACE SOIL SAMPLES TO CONFIRM THE LIMITS OF CONTAMINATION AT AREA 3
AUG 1996	MONITORING WELL INSTALLATION	ABB-ES	5 WELLS	57M-96-09X THRU 57M-96-13X	EVALUATE AND MONITOR GROUND WATER QUALITY IN THE VICINTY OF AOC 57 AREA 3
SEPT AND OCT 1996	GROUNDWATER SAMPLING	ABB-ES	7 WELLS	G3M-92-07X, 57M-95-03X, 57M- 96-09X THRU 57M-96-13X	MONITOR GROUND WATER QUALITY AT AOC 57 AREA 3
JAN 1997	IN-SITU HYDRAULIC CONDUCTIVITY TESTING	ABB-ES	5 WELLS	57M-96-09X THRU 57M-96-13X	PERMEABILITY TESTING TO ESTIMATE HYDRAULIC CONDUCTIVITIES OF THE OVERBURDEN AQUIFER
CONCLUSIONS AND RECOMMENDATIONS: REGULATORY COMMENTS ON THE DRAFT RI REQUESTED ADDITIONAL CHARACTERIZATION OF SOIL AND GROUNDWATER CONTAMINATION AT AREAS 2 AND 3. SUPPLEMENTAL INVESTIGATIONS WERE PERFORMED TO ADDRESS THESE DATA GAPS.					

TABLE 2-1
SUMMARY OF INVESTIGATION ACTIVITIES
AOC 57

FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MASSACHUSETTS

MONTH/ YEAR	ACTIVITY	CONTRACTOR	NUMBER COMPLETED	EXPLORATION/SAMPLE IDENTIFICATION	PURPOSE OF ACTIVITY
AOC 57 SUPPLEMENTAL REMEDIAL INVESTIGATION (AREAS 2 AND 3)					
MAY 1998	SURFICIAL AND SUB-SURFACE SOIL SAMPLING	HLA	16 POINTS	57S-98-01X THRU 57S-8-10X (AREA 2) 57S-98-11X THRU 57S-98-16X (AREA 3)	ASSESS THE DOWNGRADIENT EXTENT OF SITE RELATED SOIL CONTAMINATION AT AREAS 2 AND 3
MAY 1998	SURFACE WATER AND SEDIMENT SAMPLING	HLA	8 SW/SED PAIRS	57D/W-98-01X THRU 57D/W-98-03X (AREA 2); 57D/W-98-04X THRU 57D/W-98-08X (AREA 3)	ASSESS THE POTENTIAL FOR SITE CONTAMINANTS TO DISCHARGE TO WETLAND/FLOODPLAIN AREAS
MAY 1998	PIEZOMETER INSTALLATION	HLA	3 PIEZOMETERS	57P-98-02X (AREA 2) 57P-98-03X AND 57P-98-04X (AREA 3)	EVALUATE AND MONITOR GROUND WATER QUALITY DOWNGRADIENT OF AREAS 2 AND 3
MAY 1998	GROUNDWATER SAMPLING	HLA	3 PIEZOMETERS 1 WELL	57P-98-02X (AREA 2); 57P-98-03X, 57P-98-04X, AND 57M-96-11X (AREA 3)	MONITOR DOWNGRADIENT GROUND WATER QUALITY AT AOC 57 AREAS 2 AND 3
CONCLUSIONS AND RECOMMENDATIONS: DATA FROM THE SUPPLEMENTAL INVESTIGATION CHARACTERIZED THE DOWNGRADIENT EXTENT OF CONTAMINATION AT AREAS 2 AND 3. THE DATA ALSO SUPPORTED THE DECISION TO PERFORM A CONTAMINATED SOIL REMOVAL AT AREA 3.					
AOC 57 CONTAMINATED SOIL REMOVAL (AREA 3)					
MARCH 1999 TO JUNE 1999	SOIL REMOVAL AND CONFIRMATORY SAMPLING	HLA	20 SAMPLES	EX57W01X THRU EX57W17X EX57F01X THRU EX57F03X	REMOVE CONTAMINATED SOILS TO BELOW RISK-BASED LIMITS.
AOC 57 SUPPLEMENTAL GROUNDWATER SAMPLING (AREA 3)					
JUNE 2000	VERTICAL GROUNDWATER SCREENING	HLA	13 SCREENING SAMPLES WITH 10 OFF-SITE SPLIT SAMPLES	57N-00-011 THRU 57N-00-016 57N-00-021 THRU 57N-00-027	OBSERVE FOR EVIDENCE OF DOWNWARD MIGRATION OF CVOCs THROUGH VERTICAL PROFILING

TABLE 2-2
RI TEST PIT SOIL FIELD ANALYTICAL RESULTS
AOC 57

FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MASSACHUSETTS

		AREA 2									
	Lab Sample ID:	57E-95-01X	57E-95-01X	57E-95-01X	57E-95-01X	57E-95-02X	57E-95-02X	57E-95-02X	57E-95-03X	57E-95-03X	57E-95-03X
	Date analyzed:	29-Sep-95	29-Sep-95	29-Sep-95	29-Sep-95	29-Sep-95	29-Sep-95	29-Sep-95	29-Sep-95	29-Sep-95	29-Sep-95
	Depth (bgs):	0	2	6	9	0	5	10	0	2	5
	Dilution:	1.03	1.1	1.05	1.04	1.14	1.12	1.03	1.08	1.14	1.03
Analytes	Reporting Limit 1995/1996										
Vinyl Chloride	2 µg/kg/250 µg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1-DCE	5 µg/kg/250 µg/kg	5.2 U	5.5 U	5.3 U	5.2 U	5.7 U	5.6 U	5.2 U	5.4 U	5.7 U	5.2 U
t-1,2-DCE	2 µg/kg/250 µg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
c-1,2-DCE	2 µg/kg/250 µg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloroform	2 µg/kg/250 µg/kg	2.1 U	2.2 U	2.1 U	2.1 U	2.3 U	2.2 U	2.1 U	2.2 U	2.3 U	2.1 U
1,1,1-TCA	2 µg/kg/250 µg/kg	2.1 UJ	2.2 UJ	2.1 UJ	2.1 UJ	2.3 UJ	2.2 UJ	2.1 UJ	2.2 UJ	2.3 UJ	2.1 UJ
Carbon Tetrachloride	2 µg/kg/250 µg/kg	2.1 U	2.2 U	2.1 U	2.1 U	2.3 U	2.2 U	2.1 U	2.2 U	2.3 U	2.1 U
Trichloroethene	2 µg/kg/250 µg/kg	2.1 U	2.2 U	2.1 U	2.1 U	2.3 U	2.2 U	2.1 U	2.2 U	2.3 U	2.1 U
Tetrachloroethene	2 µg/kg/250 µg/kg	2.1 U	2.2 U	2.1 U	2.1 U	2.3 U	2.2 U	2.1 U	2.2 U	2.3 U	2.1 U
1,3-DCB	2 µg/kg/250 µg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,4-DCB	2 µg/kg/250 µg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2-DCB	2 µg/kg/250 µg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene	2 µg/kg/250 µg/kg	2.1 UJ	2.2 UJ	2.1 UJ	2.1 U	2.3 UJ	2.2 U	2.1 UJ	2.2 UJ	2.3 U	2.1 UJ
Toluene	2 µg/kg/250 µg/kg	2.1 U	3.2	2.1 U	2.1 UJ	2.3 U	2.2 UJ	2.1 U	2.3	2.3 UJ	2.1 U
Chlorobenzene	2 µg/kg/250 µg/kg	2.1 U	2.2 U	2.1 U	2.1 U	2.3 U	2.2 U	2.1 U	2.2 U	2.3 U	2.1 U
Ethylbenzene	2 µg/kg/250 µg/kg	2.1 U	2.2 U	2.1 U	2.1 U	2.3 U	2.2 U	2.1 U	2.2 U	2.3 U	2.1 U
m/p-Xylene	4 µg/kg/500 µg/kg	4.1 U	4.4 U	4.2 U	4.2 U	4.6 U	4.5 U	4.1 U	4.3 U	4.6 U	4.1 U
o-Xylene	2 µg/kg/250 µg/kg	2.1 U	2.2 U	2.1 U	2.1 U	2.3 U	2.2 U	2.1 U	2.2 U	2.3 U	2.1 U
Naphthalene	2 µg/kg/250 µg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TPH-DRO	100 mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TPH-GRO	100 µg/kg	100 U	110 U	110 U	100 U	110 U	110 U	100 U	110 U	110 U	100 U
TPH-IR (1995)	50 mg/kg	52 U	73	53 U	52 U	69	56 U	52 U	54 U	57 U	52 U
TPH-IR (1996)	50 mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:
Detection limits are reported for 1995/1996 field programs.
U = Concentration is less than reporting limit
J = Value is estimated
E = Concentration exceeds the maximum reporting limit
NA = Not analyzed

TABLE 2-2
RI TEST PIT SOIL FIELD ANALYTICAL RESULTS
AOC 57

FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MASSACHUSETTS

		AREA 2									
	Lab Sample ID:	57E-95-03X	57E-95-04X	57E-95-04X	57E-95-04X	57E-95-05X	57E-95-05X	57E-95-05X	57E-95-06X	57E-95-06X	57E-95-06X
	Date analyzed:	29-Sep-95	9-Oct-95	29-Sep-95	29-Sep-95	29-Sep-95	29-Sep-95	Sep-95	29-Sep-95	29-Sep-95	29-Sep-95
	Depth (bgs):	10	0	5	12	0	6	13	0	6	11
	Dilution:	1.03	1.05	1.04	1.04	1.11	1.02	1.03	1.06	1.03	1.05
Analytes	**Reporting Limit 1995/1996**										
Vinyl Chloride	2 µg/kg/250 µg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1-DCE	5 µg/kg/250 µg/kg	5.2 U	NA	5.2 U	5.2 U	5.6 U	5.1 U	5.2 U	5.3 U	5.2 U	5.3 U
t-1,2-DCE	2 µg/kg/250 µg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
c-1,2-DCE	2 µg/kg/250 µg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloroform	2 µg/kg/250 µg/kg	2.1 U	NA	2.1 U	2.1 U	2.2 U	2.0 U	2.1 U	2.1 U	2.1 U	2.1 U
1,1,1-TCA	2 µg/kg/250 µg/kg	2.1 UJ	NA	2.1 UJ	2.1 UJ	2.2 UJ	2.0 U	2.1 UJ	2.1 UJ	2.1 UJ	2.1 U
Carbon Tetrachloride	2 µg/kg/250 µg/kg	2.1 U	NA	2.1 U	2.1 U	2.2 U	2.0 U	2.1 U	2.1 U	2.1 U	2.1 U
Trichloroethene	2 µg/kg/250 µg/kg	2.1 U	NA	2.1 U	2.1 U	2.2 U	2.0 U	2.1 U	2.1 U	2.1 U	2.1 U
Tetrachloroethene	2 µg/kg/250 µg/kg	2.1 U	NA	2.1 U	2.1 U	2.2 U	2.0 U	2.1 U	2.1 U	2.1 U	2.1 U
1,3-DCB	2 µg/kg/250 µg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,4-DCB	2 µg/kg/250 µg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2-DCB	2 µg/kg/250 µg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene	2 µg/kg/250 µg/kg	2.1 UJ	NA	2.1 U	2.1 U	2.2 UJ	2.0 U	2.1 U	2.1 U	2.1 U	2.1 U
Toluene	2 µg/kg/250 µg/kg	2.1 U	NA	2.1 UJ	2.1 UJ	2.2 U	2.0 UJ	2.1 UJ	2.5 J	2.1 UJ	2.4 J
Chlorobenzene	2 µg/kg/250 µg/kg	2.1 U	NA	2.1 U	2.1 U	2.2 U	2.0 U	2.1 U	2.1 U	2.1 U	2.3
Ethylbenzene	2 µg/kg/250 µg/kg	2.1 U	NA	2.1 U	2.1 U	2.2 U	2.0 U	2.1 U	2.1 U	2.1 U	22 E
m/p-Xylene	4 µg/kg/500 µg/kg	4.1 U	NA	4.2 U	4.2 U	4.4 U	4.1 U	4.1 U	4.2 U	4.1 U	22 E
o-Xylene	2 µg/kg/250 µg/kg	2.1 U	NA	2.1 U	2.1 U	2.2 U	2.0 U	2.1 U	2.1 U	2.1 U	25 E
Naphthalene	2 µg/kg/250 µg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TPH-DRO	100 mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TPH-GRO	100 µg/kg	100 U	NA	100 U	100 U	110 U	100 U	100 U	110 U	100 U	110 U
TPH-IR (1995)	50 mg/kg	52 U	53 U	52 U	52 U	56 U	51 U	52 U	53 U	52 U	53 U
TPH-IR (1996)	50 mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:
Detection limits are reported for 1995/1996 field prog
U = Concentration is less than reporting limit
J = Value is estimated
E = Concentration exceeds the maximum reportin;
NA = Not analyzed

TABLE 2-2
RI TEST PIT SOIL FIELD ANALYTICAL RESULTS
AOC 57

FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MASSACHUSETTS

		AREA 2									
	Lab Sample ID:	57E-95-07X	57E-95-07X	57E-95-07X	57E-95-08X	57E-95-08X	57E-95-08X	57E-95-09X	57E-95-09X	57E-95-09X	57E-95-10X
	Date analyzed:	29-Sep-95	4-Oct-95	4-Oct-95	3-Oct-95	Oct-95	4-Oct-95	4-Oct-95	4-Oct-95	4-Oct-95	29-Sep-95
	Depth (bgs):	0	4	7	0	4	6	0	5	8	0
	Dilution:	1.11	390	2.5	1.43	1.49	1.18	1.1	1.37	1.22	1.11
Analytes	**Reporting Limit 1995/1996**										
Vinyl Chloride	2 µg/kg/250 µg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1-DCE	5 µg/kg/250 µg/kg	5.6 U	6100 E	13 U	7.2 U	7.5 U	5.9 U	5.5 U	6.9 U	6.1 U	5.6 U
t-1,2-DCE	2 µg/kg/250 µg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
c-1,2-DCE	2 µg/kg/250 µg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloroform	2 µg/kg/250 µg/kg	2.2 U	780 U	5.0 U	2.9 U	3.0 U	2.4 U	2.2 U	2.7 U	2.4 U	2.2 U
1,1,1-TCA	2 µg/kg/250 µg/kg	2.2 UJ	780 U	5.0 U	2.9 U	3.0 U	2.4 U	2.2 U	2.7 U	2.4 U	2.2 U
Carbon Tetrachloride	2 µg/kg/250 µg/kg	2.2 U	780 U	5.0 U	2.9 U	3.0 U	2.4 U	2.2 U	2.7 U	2.4 U	2.2 U
Trichloroethene	2 µg/kg/250 µg/kg	2.2 U	780 U	5.0 U	2.9 U	3.0 U	2.4 U	2.2 U	2.7 U	2.4 U	2.2 U
Tetrachloroethene	2 µg/kg/250 µg/kg	2.2 U	780 U	5.0 U	2.9 U	3.0 U	2.4 U	2.2 U	2.7 U	2.4 U	2.2 U
1,3-DCB	2 µg/kg/250 µg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,4-DCB	2 µg/kg/250 µg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2-DCB	2 µg/kg/250 µg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene	2 µg/kg/250 µg/kg	2.2 U	780 U	5.0 U	2.9 U	3.0 U	2.4 U	2.2 U	2.7 U	2.4 U	2.2 U
Toluene	2 µg/kg/250 µg/kg	2.2 UJ	3400	5.0 U	2.9 U	3.0 U	2.4 U	2.2 U	2.7 U	2.4 U	2.4 J
Chlorobenzene	2 µg/kg/250 µg/kg	2.2 U	780 U	5.0 U	2.9 U	3.0 U	2.4 U	2.2 U	2.7 U	2.4 U	2.2 U
Ethylbenzene	2 µg/kg/250 µg/kg	2.2 U	14000	5.0 U	2.9 U	3.0 U	2.4 U	2.2 U	2.7 U	2.4 U	2.2 U
m/p-Xylene	4 µg/kg/500 µg/kg	4.4 U	56000	10 U	5.7 U	6.0 U	4.7 U	4.4 U	5.5 U	4.9 U	4.4 U
o-Xylene	2 µg/kg/250 µg/kg	2.2 U	36000	5.0 U	2.9 U	3.0 U	2.4 U	2.2 U	2.7 U	2.4 U	2.2 U
Naphthalene	2 µg/kg/250 µg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TPH-DRO	100 mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TPH-GRO	100 µg/kg	110 U	8.6 e+ 6E	250	140 U	150 U	120 U	110 U	140 U	120 U	110 U
TPH-IR (1995)	50 mg/kg	61	65000	130 U	1400	75 U	59 U	55 U	69 U	61 U	80
TPH-IR (1996)	50 mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:
Detection limits are reported for 1995/1996 field prog
U = Concentration is less than reporting limit
J = Value is estimated
E = Concentration exceeds the maximum reportin
NA = Not analyzed

TABLE 2-2
RI TEST PIT SOIL FIELD ANALYTICAL RESULTS
AOC 57

FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MASSACHUSETTS

		AREA 2									
	Lab Sample ID:	57E-95-10X	57E-95-10X	57E-95-11X	57E-95-11X	57E-95-11X	57E-95-12X	57E-95-12X	57E-95-12X	57E-95-13X	57E-95-13X
	Date analyzed:	29-Sep-95	29-Sep-95	29-Sep-95	29-Sep-95	29-Sep-95	3-Oct-95	3-Oct-95	4-Oct-95	3-Oct-95	3-Oct-95
	Depth (bgs):	6	10	0	6	13	0	4	13	0	5
	Dilution:	1.05	1.02	1.04	1.04	1.03	1.08	3.12	1.33	1.23	1.19
Analytes	Reporting Limit 1995/1996										
Vinyl Chloride	2 µg/kg/250 µg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1-DCE	5 µg/kg/250 µg/kg	5.3 U	5.1 U	5.2 U	5.2 U	5.2 U	5.4 U	16 U	6.7 U	6.2 U	6.0 U
t-1,2-DCE	2 µg/kg/250 µg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
c-1,2-DCE	2 µg/kg/250 µg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloroform	2 µg/kg/250 µg/kg	2.1 U	2.0 U	2.1 U	2.1 U	2.1 U	2.2 U	6.2 U	2.7 U	2.5 U	2.4 U
1,1,1-TCA	2 µg/kg/250 µg/kg	2.1 UJ	2.0 U	2.1 U	2.1 U	2.1 UJ	2.2 U	6.2 U	2.7 U	2.5 U	2.4 U
Carbon Tetrachloride	2 µg/kg/250 µg/kg	2.1 U	2.0 U	2.1 U	2.1 U	2.1 U	2.2 U	6.2 U	2.7 U	2.5 U	2.4 U
Trichloroethene	2 µg/kg/250 µg/kg	2.1 U	2.0 U	2.1 U	2.1 U	2.1 U	2.2 U	6.2 U	2.7 U	2.5 U	2.4 U
Tetrachloroethene	2 µg/kg/250 µg/kg	2.1 U	2.0 U	2.1 U	2.1 U	2.1 U	2.2 U	6.2 U	2.7 U	2.5 U	2.4 U
1,3-DCB	2 µg/kg/250 µg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,4-DCB	2 µg/kg/250 µg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2-DCB	2 µg/kg/250 µg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene	2 µg/kg/250 µg/kg	2.1 U	2.0 U	2.1 U	2.1 U	2.1 UJ	2.2 U	6.2 U	2.7 U	2.5 U	2.4 U
Toluene	2 µg/kg/250 µg/kg	2.1 UJ	2.0 UJ	2.1 UJ	2.1 UJ	2.1 U	2.2 U	20	2.7 U	2.5 U	2.4 U
Chlorobenzene	2 µg/kg/250 µg/kg	2.1 U	2.0 U	2.1 U	2.1 U	2.1 U	2.2 U	42	2.7 U	2.5 U	2.4 U
Ethylbenzene	2 µg/kg/250 µg/kg	2.1 U	2.0 U	2.1 U	2.1 U	2.1 U	2.2 U	65	2.7 U	2.5 U	2.4 U
m/p-Xylene	4 µg/kg/500 µg/kg	4.2 U	4.1 U	4.2 U	4.2 U	4.1 U	4.3 U	97	5.3 U	4.9 U	4.8 U
o-Xylene	2 µg/kg/250 µg/kg	2.1 U	2.0 U	2.1 U	2.1 U	2.1 U	2.2 U	220	2.7 U	2.5 U	2.4 U
Naphthalene	2 µg/kg/250 µg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TPH-DRO	100 mg/kg	NA	NA	NA	NA	NA	110 U	NA	NA	NA	NA
TPH-GRO	100 µg/kg	110 U	100 U	100 U	100 U	100 U	110 U	79000 E	130 U	120 U	120 U
TPH-IR (1995)	50 mg/kg	53 U	51 U	75	52 U	130	9700	1400	67 U	110	60 U
TPH-IR (1996)	50 mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:
Detection limits are reported for 1995/1996 field prog
U = Concentration is less than reporting limit
J = Value is estimated
E = Concentration exceeds the maximum reportin
NA = Not analyzed

TABLE 2-2
RI TEST PIT SOIL FIELD ANALYTICAL RESULTS
AOC 57

FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MASSACHUSETTS

		AREA 2									
	Lab Sample ID:	57E-95-13X	57E-95-14X	57E-95-14X	57E-95-14X	57E-95-15X	57E-95-15X	57E-95-15X	57E-95-16X	57E-95-16X	57E-95-16X
	Date analyzed:	3-Oct-95	3-Oct-95	3-Oct-95	3-Oct-95	4-Oct-95	5-Oct-95	4-Oct-95	4-Oct-95	4-Oct-95	4-Oct-95
	Depth (bgs):	11	0	2	6	0	2	5	0	3	5
	Dilution:	1.22	1.03	1.69	1.2	1.32	1.64	1.12	1.25	1.04	1.43
Analytes	**Reporting Limit 1995/1996**										
Vinyl Chloride	2 µg/kg/250 µg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1-DCE	5 µg/kg/250 µg/kg	6.1 U	5.2 U	8.5 U	6.0 U	6.6 UJ	8.2 U	5.6 U	6.3 U	5.2 UJ	7.2 U
t-1,2-DCE	2 µg/kg/250 µg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
c-1,2-DCE	2 µg/kg/250 µg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloroform	2 µg/kg/250 µg/kg	2.4 U	2.1 U	3.4 U	2.4 U	2.6 U	3.3 U	2.2 U	2.5 U	2.1 U	2.9 U
1,1,1-TCA	2 µg/kg/250 µg/kg	2.4 U	2.1 U	3.4 U	2.4 U	2.6 U	3.3 U	2.2 U	2.5 U	2.1 U	2.9 U
Carbon Tetrachloride	2 µg/kg/250 µg/kg	2.4 U	2.1 U	3.4 U	2.4 U	2.6 U	3.3 U	2.2 U	2.5 U	2.1 U	2.9 U
Trichloroethene	2 µg/kg/250 µg/kg	2.4 U	2.1 U	3.4 U	2.4 U	2.6 U	3.3 U	2.2 U	2.5 U	2.1 U	2.9 U
Tetrachloroethene	2 µg/kg/250 µg/kg	2.4 U	2.1 U	3.4 U	2.4 U	2.6 U	4.8	2.2 U	2.5 U	2.1 U	2.9 U
1,3-DCB	2 µg/kg/250 µg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,4-DCB	2 µg/kg/250 µg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2-DCB	2 µg/kg/250 µg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene	2 µg/kg/250 µg/kg	2.4 U	2.1 U	3.4 U	2.4 U	2.6 U	3.3 U	2.2 U	2.5 U	2.1 U	2.9 U
Toluene	2 µg/kg/250 µg/kg	2.4 U	2.1 U	3.4 U	2.4 U	2.6 U	5.6	2.2 U	2.5 U	65	2.9 U
Chlorobenzene	2 µg/kg/250 µg/kg	2.4 U	2.1 U	3.4 U	2.4 U	2.6 U	16	2.2 U	2.5 U	2.1 U	2.9 U
Ethylbenzene	2 µg/kg/250 µg/kg	2.4 U	2.1 U	3.4 U	2.4 U	2.6 U	54	2.2 U	2.5 U	7.9	2.9 U
m/p-Xylene	4 µg/kg/500 µg/kg	4.9 U	4.1 U	6.8 U	4.8 U	5.3 U	75	4.5 U	5.0 U	4.2 U	5.7 U
o-Xylene	2 µg/kg/250 µg/kg	2.4 U	2.1 U	3.4 U	2.4 U	2.6 U	170	2.2 U	2.5 U	2.1 U	2.9 U
Naphthalene	2 µg/kg/250 µg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TPH-DRO	100 mg/kg	120 U	NA	170 U	120 U	NA	900	NA	NA	NA	NA
TPH-GRO	100 µg/kg	120 U	100 U	170 U	120 U	130 U	49000 E	110 U	130 U	100 U	140 U
TPH-IR (1995)	50 mg/kg	61 U	52 U	160	60 U	5000	28000	56 U	120	8000	72 U
TPH-IR (1996)	50 mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:
Detection limits are reported for 1995/1996 field prog
U = Concentration is less than reporting limit
J = Value is estimated
E = Concentration exceeds the maximum reportin
NA = Not analyzed

TABLE 2-2
RI TEST PIT SOIL FIELD ANALYTICAL RESULTS
AOC 57

FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MASSACHUSETTS

		AREA 2									
	Lab Sample ID:	57E-95-17X	57E-95-17X	57E-95-17X	57E-95-18X	57E-95-18X	57E-95-18X	57E-95-19X	57E-95-19X	57E-95-19X	57E-95-20X
	Date analyzed:	4-Oct-95	5-Oct-95	5-Oct-95	5-Oct-95	4-Oct-95	5-Oct-95	5-Oct-95	4-Oct-95	5-Oct-95	4-Oct-95
	Depth (bgs):	0	2	5	0	2	3	0	2	3	0
	Dilution:	1.23	1.45	5.9	1.43	1.28	1.25	1.02	1.39	1.28	1.08
Analytes	Reporting Limit 1995/1996										
Vinyl Chloride	2 µg/kg/250 µg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1-DCE	5 µg/kg/250 µg/kg	6.2 UJ	7.3 U	30 U	7.2 U	6.4 U	6.3 U	5.1 U	7.0 UJ	6.4 U	5.4 U
t-1,2-DCE	2 µg/kg/250 µg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
c-1,2-DCE	2 µg/kg/250 µg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloroform	2 µg/kg/250 µg/kg	2.5 U	2.9 U	12 U	2.9 U	2.6 U	4.9	2.0 U	2.8 U	2.6 U	2.2 U
1,1,1-TCA	2 µg/kg/250 µg/kg	2.5 U	2.9 U	12 U	2.9 U	2.6 U	2.5 U	2.0 U	2.8 U	2.6 U	2.2 U
Carbon Tetrachloride	2 µg/kg/250 µg/kg	2.5 U	2.9 U	12 U	2.9 U	2.6 U	2.5 U	2.0 U	2.8 U	2.6 U	2.2 U
Trichloroethene	2 µg/kg/250 µg/kg	2.5 U	2.9 U	21	2.9 U	2.6 U	2.5 U	2.0 U	2.8 U	2.6 U	2.2 U
Tetrachloroethene	2 µg/kg/250 µg/kg	2.5 U	2.9 U	12 U	2.9 U	2.6 U	2.5 U	2.0 U	2.8 U	2.6 U	2.2 U
1,3-DCB	2 µg/kg/250 µg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,4-DCB	2 µg/kg/250 µg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2-DCB	2 µg/kg/250 µg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene	2 µg/kg/250 µg/kg	2.5 U	2.9 U	12 U	2.9 U	2.6 U	2.5 U	2.0 U	2.8 U	2.6 U	2.2 U
Toluene	2 µg/kg/250 µg/kg	2.5 U	2.9 U	12 U	2.9 U	2.6 U	2.5 U	2.0 U	2.8 U	2.6 U	2.2 U
Chlorobenzene	2 µg/kg/250 µg/kg	2.5 U	2.9 U	150	2.9 U	2.6 U	2.5 U	2.0 U	2.8 U	2.6 U	2.2 U
Ethylbenzene	2 µg/kg/250 µg/kg	2.5 U	2.9 U	71	2.9 U	2.6 U	2.5 U	2.0 U	2.8 U	2.6 U	2.2 U
m/p-Xylene	4 µg/kg/500 µg/kg	4.9 U	5.8 U	72	5.7 U	5.1 U	5.0 U	4.1 U	5.6 U	5.1 U	4.3 U
o-Xylene	2 µg/kg/250 µg/kg	2.5 U	2.9 U	220	2.9 U	2.6 U	2.5 U	2.0 U	2.8 U	2.6 U	2.2 U
Naphthalene	2 µg/kg/250 µg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TPH-DRO	100 mg/kg	NA	150 U	120	NA	NA	NA	NA	NA	NA	NA
TPH-GRO	100 µg/kg	120 U	5800 E	52000 E	550	130 U	130 U	100 U	140 U	130 U	110 U
TPH-IR (1995)	50 mg/kg	3400	2000	620	72 U	64 U	63 U	68	70 U	64 U	54 U
TPH-IR (1996)	50 mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:
Detection limits are reported for 1995/1996 field prog
U = Concentration is less than reporting limit
J = Value is estimated
E = Concentration exceeds the maximum reportin;
NA = Not analyzed

TABLE 2-2
RI TEST PIT SOIL FIELD ANALYTICAL RESULTS
AOC 57

FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MASSACHUSETTS

		AREA 2									
	Lab Sample ID:	57E-95-20X	57E-95-20X	57E-95-25X	57E-95-25X	57E-95-25X	57E-95-26X	57E-95-26X	57E-95-26X	57E-95-27X	57E-95-27X
	Date analyzed:	4-Oct-95	4-Oct-95	28-Sep-95	28-Sep-95	28-Sep-95	28-Sep-95	28-Sep-95	6-Oct-95	6-Oct-95	6-Oct-95
	Depth (bgs):	3	5	0	2	12	0	5	11	0	2
	Dilution:	1.05	1.16	1.03	1.12	1.03	1.03	1.04	1.04	1.07	1.12
Analytes	Reporting Limit 1995/1996										
Vinyl Chloride	2 µg/kg/250 µg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1-DCE	5 µg/kg/250 µg/kg	5.3 UJ	5.8 U	5.2 U	5.6 U	5.2 U	5.2 U	5.2 U	5.2 U	5.4 U	5.6 U
t-1,2-DCE	2 µg/kg/250 µg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
c-1,2-DCE	2 µg/kg/250 µg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloroform	2 µg/kg/250 µg/kg	2.1 U	2.3 U	2.1 U	2.2 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.2 U
1,1,1-TCA	2 µg/kg/250 µg/kg	2.1 U	2.3 U	2.1 U	2.2 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.2 U
Carbon Tetrachloride	2 µg/kg/250 µg/kg	2.1 U	2.3 U	2.1 U	2.2 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.2 U
Trichloroethene	2 µg/kg/250 µg/kg	2.1 U	2.3 U	2.1 U	2.2 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.2 U
Tetrachloroethene	2 µg/kg/250 µg/kg	2.5	2.3 U	2.1 U	2.2 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.2 U
1,3-DCB	2 µg/kg/250 µg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,4-DCB	2 µg/kg/250 µg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2-DCB	2 µg/kg/250 µg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene	2 µg/kg/250 µg/kg	2.1 U	2.3 U	2.1 U	2.2 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.2 U
Toluene	2 µg/kg/250 µg/kg	2.1 U	2.3 U	2.1 U	2.2 U	2.1 U	2.1 U	2.1 UJ	2.1 U	2.1 U	2.2 U
Chlorobenzene	2 µg/kg/250 µg/kg	2.1 U	2.3 U	2.1 U	2.2 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.2 U
Ethylbenzene	2 µg/kg/250 µg/kg	2.1 U	2.3 U	2.1 U	2.2 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.2 U
m/p-Xylene	4 µg/kg/500 µg/kg	4.2 U	4.6 U	4.1 U	4.5 U	4.1 U	4.1 U	4.2 U	4.2 U	4.3 U	4.5 U
o-Xylene	2 µg/kg/250 µg/kg	2.1 U	2.3 U	2.1 U	2.2 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.2 U
Naphthalene	2 µg/kg/250 µg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TPH-DRO	100 mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TPH-GRO	100 µg/kg	110 U	120 U	100 U	110 U	100 U	100 U	100 U	100 U	110 U	110 U
TPH-IR (1995)	50 mg/kg	3400	58 U	52 U	480	52 U	260	52 U	52 U	98	82
TPH-IR (1996)	50 mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:
Detection limits are reported for 1995/1996 field prog
U = Concentration is less than reporting limit
J = Value is estimated
E = Concentration exceeds the maximum reportin
NA = Not analyzed

TABLE 2-2
RI TEST PIT SOIL FIELD ANALYTICAL RESULTS
AOC 57

FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MASSACHUSETTS

		AREA 3									
	Lab Sample ID:	57E-95-27X	57E-95-21X	57E-95-21X	57E-95-21X	57E-95-22X	57E-95-22X	57E-95-22X	57E-95-23X	57E-95-23X	57E-95-23X
	Date analyzed:	6-Oct-95	5-Oct-95	5-Oct-95	5-Oct-95	6-Oct-95	5-Oct-95	5-Oct-95	6-Oct-95	5-Oct-95	5-Oct-95
	Depth (bgs):	12	0	6	10	0	4	10	0	4	10
	Dilution:	1.04	1.22	1.09	1.03	1.16	1.11	1.03	1.15	1.03	1.04
Analytes	**Reporting Limit 1995/1996**										
Vinyl Chloride	2 µg/kg/250 µg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1-DCE	5 µg/kg/250 µg/kg	5.2 U	6.1 U	5.5 U	5.2 U	5.8 U	5.6 U	5.2 U	5.8 U	5.2 U	5.2 U
t-1,2-DCE	2 µg/kg/250 µg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
c-1,2-DCE	2 µg/kg/250 µg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloroform	2 µg/kg/250 µg/kg	2.1 U	2.4 U	2.2 U	2.1 U	2.3 U	2.2 U	2.1 U	2.3 U	2.1 U	2.1 U
1,1,1-TCA	2 µg/kg/250 µg/kg	2.1 U	2.4 U	2.2 U	2.1 U	2.3 U	2.2 U	2.1 U	2.3 U	2.1 U	2.1 U
Carbon Tetrachloride	2 µg/kg/250 µg/kg	2.1 U	2.4 U	2.2 U	2.1 U	2.3 U	2.2 U	2.1 U	2.3 U	2.1 U	2.1 U
Trichloroethene	2 µg/kg/250 µg/kg	2.1 U	2.4 U	2.2 U	2.1 U	2.3 U	2.2 U	2.1 U	2.3 U	2.1 U	2.1 U
Tetrachloroethene	2 µg/kg/250 µg/kg	2.1 U	2.4 U	2.2 U	2.1 U	2.3 U	2.2 U	2.1 U	2.3 U	2.1 U	2.1 U
1,3-DCB	2 µg/kg/250 µg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,4-DCB	2 µg/kg/250 µg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2-DCB	2 µg/kg/250 µg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene	2 µg/kg/250 µg/kg	2.1 U	2.4 U	2.2 U	2.1 U	2.3 U	2.2 U	2.1 U	2.3 U	2.1 U	2.1 U
Toluene	2 µg/kg/250 µg/kg	2.1 U	2.4 U	2.2 U	2.1 U	2.3 U	2.2 U	2.1 U	2.3 U	2.1 U	2.1 U
Chlorobenzene	2 µg/kg/250 µg/kg	2.1 U	2.4 U	2.2 U	2.1 U	2.3 U	2.7	2.1 U	2.3 U	2.1 U	2.1 U
Ethylbenzene	2 µg/kg/250 µg/kg	2.1 U	2.4 U	2.2 U	2.1 U	2.3 U	2.2 U	2.1 U	2.3 U	2.1 U	2.1 U
m/p-Xylene	4 µg/kg/500 µg/kg	4.2 U	4.9 U	4.4 U	4.1 U	4.6 U	4.4 U	4.1 U	4.6 U	4.1 U	4.2 U
o-Xylene	2 µg/kg/250 µg/kg	2.1 U	2.4 U	2.2 U	2.1 U	2.3 U	2.2 U	2.1 U	2.3 U	2.1 U	2.1 U
Naphthalene	2 µg/kg/250 µg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TPH-DRO	100 mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TPH-GRO	100 µg/kg	100 U	120 U	110 U	100 U	120 U	110 U	100 U	460	100 U	100 U
TPH-IR (1995)	50 mg/kg	52 U	160	55 U	52 U	58 U	56 U	52 U	58 U	52 U	52 U
TPH-IR (1996)	50 mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:
Detection limits are reported for 1995/1996 field prog
U = Concentration is less than reporting limit
J = Value is estimated
E = Concentration exceeds the maximum reportin
NA = Not analyzed

TABLE 2-2
RI TEST PIT SOIL FIELD ANALYTICAL RESULTS
AOC 57

FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MASSACHUSETTS

		AREA 3									
	Lab Sample ID:	57E-95-24X	57E-95-24X	57E-95-24X	57E-95-24X	57E-96-28X	57E-96-28X	57E-96-28X	57E-96-28X	57E-96-28X	57E-96-29X
	Date analyzed:	5-Oct-95	6-Oct-95	5-Oct-95	5-Oct-95	20-Aug-96	20-Aug-96	20-Aug-96	20-Aug-96	20-Aug-96	20-Aug-96
	Depth (bgs):	0	4	7	10	3	6	8	9	10	4
	Dilution:	1.09	1.27	1.04	1.25	130	138	134	159	155	131
Analytes	Reporting Limit 1995/1996										
Vinyl Chloride	2 µg/kg/250 µg/kg	NA	NA	NA	NA	260 U	280 U	270 U	320 U	310 U	260 U
1,1-DCE	5 µg/kg/250 µg/kg	5.5 U	6.4 U	5.2 U	6.3 U	260 U	280 U	270 U	320 U	310 U	260 U
t-1,2-DCE	2 µg/kg/250 µg/kg	NA	NA	NA	NA	260 U	280 U	270 U	320 U	310 U	260 U
c-1,2-DCE	2 µg/kg/250 µg/kg	NA	NA	NA	NA	260 U	280 U	270 U	320 U	310 U	260 U
Chloroform	2 µg/kg/250 µg/kg	2.2 U	2.5 U	6.2	2.5 U	260 U	280 U	270 U	320 U	310 U	260 U
1,1,1-TCA	2 µg/kg/250 µg/kg	2.2 U	2.5 U	2.1 U	2.5 U	260 U	280 U	270 U	320 U	310 U	260 U
Carbon Tetrachloride	2 µg/kg/250 µg/kg	2.2 U	2.5 U	2.1 U	2.5 U	260 U	280 U	270 U	320 U	310 U	260 U
Trichloroethene	2 µg/kg/250 µg/kg	2.2 U	2.5 U	2.1 U	2.5 U	260 U	280 U	270 U	320 U	310 U	260 U
Tetrachloroethene	2 µg/kg/250 µg/kg	2.2 U	2.5 U	2.1 U	2.5 U	260 U	280 U	270 U	320 U	310 U	260 U
1,3-DCB	2 µg/kg/250 µg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,4-DCB	2 µg/kg/250 µg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2-DCB	2 µg/kg/250 µg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene	2 µg/kg/250 µg/kg	2.2 U	2.5 U	2.1 U	2.5 U	260 U	280 U	270 U	320 U	310 U	260 U
Toluene	2 µg/kg/250 µg/kg	2.2 U	2.5 U	2.1 U	2.5 U	260 U	280 U	270 U	320 U	310 U	260 U
Chlorobenzene	2 µg/kg/250 µg/kg	2.2 U	2.5 U	19	2.5 U	260 U	280 U	270 U	320 U	310 U	260 U
Ethylbenzene	2 µg/kg/250 µg/kg	2.2 U	2.5 U	15	2.5 U	260 U	280 U	270 U	320 U	310 U	260 U
m/p-Xylene	4 µg/kg/500 µg/kg	4.4 U	5.7	20	5.0 U	520 U	560	540 U	640 U	620 U	520 U
o-Xylene	2 µg/kg/250 µg/kg	2.2 U	27	5.8	2.5 U	260 U	280 U	270 U	320 U	310 U	260 U
Naphthalene	2 µg/kg/250 µg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TPH-DRO	100 mg/kg	NA	180	310	NA	NA	NA	NA	NA	NA	NA
TPH-GRO	100 µg/kg	110 U	32000 E	33000 E	130 U	NA	NA	NA	NA	NA	NA
TPH-IR (1995)	50 mg/kg	55 U	33000	6000	63 U	NA	NA	NA	NA	NA	NA
TPH-IR (1996)	50 mg/kg	NA	NA	NA	NA	51 U	16000	1500	170	160	1200

Notes:
Detection limits are reported for 1995/1996 field prog
U = Concentration is less than reporting limit
J = Value is estimated
E = Concentration exceeds the maximum reportin;
NA = Not analyzed

TABLE 2-2
RI TEST PIT SOIL FIELD ANALYTICAL RESULTS
AOC 57

FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MASSACHUSETTS

		AREA 3									
	Lab Sample ID:	57E-96-29X	57E-96-29X	57E-96-29X	57E-96-29X	57E-96-30X	57E-96-30X	57E-96-30X	57E-96-30X	57E-96-30X	57E-96-30X
	Date analyzed:	20-Aug-96	20-Aug-96	20-Aug-96	20-Aug-96	22-Aug-96	22-Aug-96	22-Aug-96	22-Aug-96	22-Aug-96	22-Aug-96
	Depth (bgs):	5	7	10	11	2	4	4D	5	5A	6
	Dilution:	135	138	158	153	135	138	138	140	131	130
Analytes	Reporting Limit 1995/1996										
Vinyl Chloride	2 µg/kg/250 µg/kg	270 U	280 U	320 U	310 U	270 U	280 U	280 U	280 U	260 U	260 U
1,1-DCE	5 µg/kg/250 µg/kg	270 U	280 U	320 U	310 U	270 U	280 U	280 U	280 U	260 U	260 U
t-1,2-DCE	2 µg/kg/250 µg/kg	270 U	280 U	320 U	310 U	270 U	280 U	280 U	280 U	260 U	260 U
c-1,2-DCE	2 µg/kg/250 µg/kg	270 U	280 U	320 U	310 U	270 U	280 U	280 U	280 U	260 U	260 U
Chloroform	2 µg/kg/250 µg/kg	270 U	280 U	320 U	310 U	270 U	280 U	280 U	280 U	260 U	260 U
1,1,1-TCA	2 µg/kg/250 µg/kg	270 U	280 U	320 U	310 U	270 U	280 U	280 U	280 U	260 U	260 U
Carbon Tetrachloride	2 µg/kg/250 µg/kg	270 U	280 U	320 U	310 U	270 U	280 U	280 U	280 U	260 U	260 U
Trichloroethene	2 µg/kg/250 µg/kg	270 U	280 U	320 U	310 U	270 U	280 U	280 U	280 U	260 U	260 U
Tetrachloroethene	2 µg/kg/250 µg/kg	270 U	280 U	320 U	310 U	270 U	280 U	280 U	280 U	260 U	260 U
1,3-DCB	2 µg/kg/250 µg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,4-DCB	2 µg/kg/250 µg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2-DCB	2 µg/kg/250 µg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene	2 µg/kg/250 µg/kg	270 U	280 U	320 U	310 U	270 U	280 U	280 U	280 U	260 U	260 U
Toluene	2 µg/kg/250 µg/kg	270 U	280 U	320 U	310 U	270 U	280 U	280 U	280 U	260 U	260 U
Chlorobenzene	2 µg/kg/250 µg/kg	270 U	280 U	320 U	310 U	270 U	280 U	280 U	280 U	260 U	260 U
Ethylbenzene	2 µg/kg/250 µg/kg	270 U	280 U	320 U	310 U	270 U	280 U	280 U	3000	260 U	490
m/p-Xylene	4 µg/kg/500 µg/kg	540 U	550 U	630 U	610 U	540 U	550 U	550 U	13000	580	2600
o-Xylene	2 µg/kg/250 µg/kg	270 U	280 U	320 U	310 U	270 U	280 U	280 U	8000	790	1200
Naphthalene	2 µg/kg/250 µg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TPH-DRO	100 mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TPH-GRO	100 µg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TPH-IR (1995)	50 mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TPH-IR (1996)	50 mg/kg	4500	57 U	63	160	15000	15000	NA	53000 E	1000	8900

Notes:
Detection limits are reported for 1995/1996 field prog
U = Concentration is less than reporting limit
J = Value is estimated
E = Concentration exceeds the maximum reportin
NA = Not analyzed

TABLE 2-2
RI TEST PIT SOIL FIELD ANALYTICAL RESULTS
AOC 57

FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MASSACHUSETTS

		AREA 3									
	Lab Sample ID:	57E-96-30X	57E-96-30X	57E-96-30X	57E-96-31X	57E-96-31X	57E-96-31X	57E-96-31X	57E-96-31X	57E-96-31X	57E-96-31X
	Date analyzed:	22-Aug-96	22-Aug-96	22-Aug-96	27-Aug-96	26-Aug-96	26-Aug-96	27-Aug-96	27-Aug-96	27-Aug-96	27-Aug-96
	Depth (bgs):	9	9A	11	4	6	6D	7	9	10	9A
	Dilution:	151	160	161	675	135	135	134	740	1500	161
Analytes	**Reporting Limit 1995/1996**										
Vinyl Chloride	2 µg/kg/250 µg/kg	300 U	320 U	320 U	1400 U	270 U	270 U	270 U	1500 U	3000 U	320 U
1,1-DCE	5 µg/kg/250 µg/kg	300 U	320 U	320 U	1400 U	270 U	270 U	270 U	1500 U	3000 U	320 U
t-1,2-DCE	2 µg/kg/250 µg/kg	300 U	320 U	320 U	1400 U	270 U	270 U	270 U	1500 U	3000 U	320 U
c-1,2-DCE	2 µg/kg/250 µg/kg	300 U	320 U	320 U	1400 U	270 U	270 U	270 U	1500 U	3000 U	320 U
Chloroform	2 µg/kg/250 µg/kg	300 U	320 U	320 U	1400 U	270 U	270 U	270 U	1500 U	3000 U	320 U
1,1,1-TCA	2 µg/kg/250 µg/kg	300 U	320 U	320 U	1400 U	270 U	270 U	270 U	1500 U	3000 U	320 U
Carbon Tetrachloride	2 µg/kg/250 µg/kg	300 U	320 U	320 U	1400 U	270 U	270 U	270 U	1500 U	3000 U	320 U
Trichloroethene	2 µg/kg/250 µg/kg	300 U	320 U	320 U	1400 U	270 U	270 U	270 U	1500 U	3000 U	320 U
Tetrachloroethene	2 µg/kg/250 µg/kg	300 U	320 U	320 U	1400 U	270 U	270 U	270 U	1500 U	3000 U	320 U
1,3-DCB	2 µg/kg/250 µg/kg	NA	NA	NA	1400 U	270 U	270 U	270 U	1500 U	3000 U	320 U
1,4-DCB	2 µg/kg/250 µg/kg	NA	NA	NA	1400 U	270 U	270 U	270 U	1500 U	3000 U	320 U
1,2-DCB	2 µg/kg/250 µg/kg	NA	NA	NA	1400 U	270 U	270 U	270 U	1500 U	3000 U	320 U
Benzene	2 µg/kg/250 µg/kg	300 U	320 U	320 U	1400 U	270 U	270 U	270 U	1500 U	3000 U	320 U
Toluene	2 µg/kg/250 µg/kg	300 U	320 U	320 U	1400 U	270 U	270 U	270 U	1500 U	3000 U	320 U
Chlorobenzene	2 µg/kg/250 µg/kg	300 U	320 U	320 U	1400 U	270 U	270 U	270 U	1500 U	3000 U	320 U
Ethylbenzene	2 µg/kg/250 µg/kg	300 U	320 U	320 U	1800	270 U	270 U	270 U	1500 U	8800	320 U
m/p-Xylene	4 µg/kg/500 µg/kg	600 U	640 U	640 U	4000	540 U	540 U	540 U	3000 U	26000	640 U
o-Xylene	2 µg/kg/250 µg/kg	300 U	320 U	320 U	1600	270 U	270 U	270 U	1500 U	9900	320 U
Naphthalene	2 µg/kg/250 µg/kg	NA	NA	NA	5800 J	560	270 U	870 J	3800 J	12000 J	320 U
TPH-DRO	100 mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TPH-GRO	100 µg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TPH-IR (1995)	50 mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TPH-IR (1996)	50 mg/kg	610	1100	410	63000 E	10000	14000	55 U	9400 E	13000 E	65

Notes:
Detection limits are reported for 1995/1996 field prog
U = Concentration is less than reporting limit
J = Value is estimated
E = Concentration exceeds the maximum reportin
NA = Not analyzed

TABLE 2-3
RI SOIL BORING AND TERRAPROBE FIELD ANALYTICAL RESULTS
AOC 57

FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MASSACHUSETTS

		AREA 2									AREA 3
	Lab Sample ID: Date analyzed: Depth (bgs): Dilution:	57B-95-03X 10-Oct-95 0 1.07	57B-95-03X 11-Oct-95 5 1.04	57B-95-04X 11-Oct-95 15 1.26	57B-95-05X 11-Oct-95 15 1.32	57B-95-06X 11-Oct-95 12 1.21	57M-95-07X 12-Oct-95 4 1.23	57M-95-08A 12-Oct-95 7 1.27	57M-95-08B 12-Oct-95 4 1.29	57P-95-01A 12-Oct-95 5 1.28	57R-95-01X 10-Oct-95 0 1.07
Analytes	**Reporting Limit 1995/1996**										
Vinyl Chloride	2 µg/kg/250 µg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1-DCE	5 µg/kg/250 µg/kg	5.4 UJ	5.2 UJ	6.3 UJ	6.6 UJ	6.1 UJ	6.2 UJ	6.4 UJ	6.5 UJ	6.4 UJ	5.4 J
t-1,2-DCE	2 µg/kg/250 µg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
c-1,2-DCE	2 µg/kg/250 µg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloroform	2 µg/kg/250 µg/kg	2.1 U	2.1 UJ	2.5 U	2.6 U	2.4 U	2.5 U	2.5 U	2.6 U	2.6 U	2.1 U
1,1,1-TCA	2 µg/kg/250 µg/kg	2.1 U	2.1 U	2.5 U	2.6 U	2.4 U	2.5 U	2.5 U	2.6 U	2.6 U	2.1 U
Carbon Tetrachloride	2 µg/kg/250 µg/kg	2.1 U	2.1 U	2.5 U	2.6 U	2.4 U	2.5 U	2.5 U	2.6 U	2.6 U	2.1 U
Trichloroethene	2 µg/kg/250 µg/kg	2.1 U	2.1 U	2.5 U	2.6 U	2.4 U	2.5 U	2.5 U	2.6 U	2.6 U	2.1 U
Tetrachloroethene	2 µg/kg/250 µg/kg	2.1 U	2.1 U	2.5 U	2.6 U	2.4 U	2.5 U	2.5 U	2.6 U	2.6 U	2.1 U
1,3-DCB	2 µg/kg/250 µg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,4-DCB	2 µg/kg/250 µg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2-DCB	2 µg/kg/250 µg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene	2 µg/kg/250 µg/kg	2.1 U	2.1 U	2.5 U	2.6 U	2.4 U	2.5 U	2.5 U	2.6 U	2.6 U	2.1 U
Toluene	2 µg/kg/250 µg/kg	2.1 U	2.1 U	2.5 U	2.6 U	2.4 U	2.5 U	2.5 U	2.6 U	2.6 U	2.1 U
Chlorobenzene	2 µg/kg/250 µg/kg	2.1 U	2.1 U	2.5 U	2.6 U	2.4 U	2.5 U	2.5 U	2.6 U	2.6 U	2.1 U
Ethylbenzene	2 µg/kg/250 µg/kg	2.1 U	2.1 U	2.5 U	2.6 U	2.4 U	2.5 U	2.5 U	2.6 U	2.6 U	2.1 U
m/p-Xylene	4 µg/kg/540 µg/kg	4.3 U	4.2 U	5.0 U	5.3 U	4.8 U	4.9 U	5.1 U	5.2 U	5.1 U	4.3 U
o-Xylene	2 µg/kg/250 µg/kg	2.1 U	2.1 U	2.5 U	2.6 U	2.4 U	2.5 U	2.5 U	2.6 U	2.6 U	2.1 U
Naphthalene	2 µg/kg/250 µg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TPH-DRO	100 mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TPH-GRO	100 µg/kg	110 U	100 U	130 U	130 U	120 U	120 U	130 U	130 U	130 U	110 U
TPH-IR (1995)	50 mg/kg	480	52 U	63 U	66 U	61 U	62 U	64 U	65	64 U	54 U
TPH-IR (1996)	50 mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

U = Concentration is less than reporting limit
J = Value is estimated
E = Concentration exceeds the maximum reporting limit
NA = Not analyzed
B = Analyte found in method blank

TABLE 2-3
RI SOIL BORING AND TERRAPROBE FIELD ANALYTICAL RESULTS
AOC 57

FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MASSACHUSETTS

		AREA3									
	Lab Sample ID:	57R-95-01X	57R-95-01X	57R-95-02X	57R-95-02X	57R-95-02X	57R-95-03X	57R-95-03X	57R-95-03X	57R-95-04X	57R-95-04X
	Date analyzed:	10-Oct-95	10-Oct-95	10-Oct-95	10-Oct-95	10-Oct-95	10-Oct-95	11-Oct-95	11-Oct-95	11-Oct-95	11-Oct-95
	Depth (bgs):	6	12	0	4	10	0	4	10	0	4
	Dilution:	1.04	1.11	1.08	1.09	1.33	1.08	1.04	1.31	1.08	1.05
Analytes	Reporting Limit 1995/1996										
Vinyl Chloride	2 µg/kg/250 µg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1-DCE	5 µg/kg/250 µg/kg	5.2 UJ	5.6 UJ	5.4 UJ	5.5 UJ	6.7 UJ	5.4 UJ	5.2 UJ	6.6 UJ	5.4 UJ	5.3 UJ
t-1,2-DCE	2 µg/kg/250 µg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
c-1,2-DCE	2 µg/kg/250 µg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloroform	2 µg/kg/250 µg/kg	2.1 U	2.2 U	2.2 U	2.2 U	2.7 U	2.2 U	2.1 UJ	2.6 U	2.2 UJ	2.1 UJ
1,1,1-TCA	2 µg/kg/250 µg/kg	2.1 UJ	2.2 U	2.2 U	2.2 U	2.7 U	2.2 UJ	2.1 U	2.6 UJ	2.2 U	2.1 U
Carbon Tetrachloride	2 µg/kg/250 µg/kg	2.1 U	2.2 U	2.2 U	2.2 U	2.7 U	2.2 U	2.1 U	2.6 U	2.2 U	2.1 U
Trichloroethene	2 µg/kg/250 µg/kg	2.1 U	2.2 U	2.2 U	2.2 U	2.7 U	2.2 U	2.1 U	2.6 U	2.2 U	2.1 U
Tetrachloroethene	2 µg/kg/250 µg/kg	2.1 U	2.2 U	2.2 U	2.2 U	2.7 U	2.2 U	2.1 U	2.6 U	2.2 U	2.1 U
1,3-DCB	2 µg/kg/250 µg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,4-DCB	2 µg/kg/250 µg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2-DCB	2 µg/kg/250 µg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene	2 µg/kg/250 µg/kg	2.1 U	2.2 U	2.2 U	2.2 U	2.7 U	2.2 U	2.1 U	2.6 U	2.2 U	2.1 U
Toluene	2 µg/kg/250 µg/kg	2.1 U	2.2 U	2.2 U	2.2 U	2.7 U	2.2 U	2.1 U	2.6 U	2.2 U	2.1 U
Chlorobenzene	2 µg/kg/250 µg/kg	2.1 U	2.2 U	2.2 U	2.2 U	2.7 U	2.2 U	2.1 U	2.6 U	2.2 U	2.1 U
Ethylbenzene	2 µg/kg/250 µg/kg	2.1 U	2.2 U	2.2 U	2.2 U	2.7 U	2.2 U	2.1 U	2.6 U	2.2 U	2.1 U
m/p-Xylene	4 µg/kg/540 µg/kg	4.2 U	4.4 U	4.3 U	4.4 U	5.3 U	4.3 U	4.2 U	5.2 U	4.3 U	4.2 U
o-Xylene	2 µg/kg/250 µg/kg	2.1 U	2.2 U	2.2 U	2.2 U	2.7 U	2.2 U	2.1 U	2.6 U	2.2 U	2.1 U
Naphthalene	2 µg/kg/250 µg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TPH-DRO	100 mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TPH-GRO	100 µg/kg	100 U	110 U	110 U	110 U	130 U	110 U	100 U	130 U	110 U	110 U
TPH-IR (1995)	50 mg/kg	52 U	56 U	140	55 U	67 U	450	52 U	400	95	440
TPH-IR (1996)	50 mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

U = Concentration is less than reporting limit
J = Value is estimated
E = Concentration exceeds the maximum reportin
NA = Not analyzed
B = Analyte found in method blank

TABLE 2-3
RI SOIL BORING AND TERRAPROBE FIELD ANALYTICAL RESULTS
AOC 57

FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MASSACHUSETTS

		AREA 3									
	Lab Sample ID: Date analyzed: Depth (bgs): Dilution:	57R-95-04X 10-Oct-95 10 1.3	57R-95-05X 11-Oct-95 0 1.06	57R-95-05X 11-Oct-95 4 1.06	57R-95-05X 11-Oct-95 10 2.64	57B-96-07X 29-Aug-96 0 680	57B-96-07X Aug-96 5 800	57B-96-07X 29-Aug-96 10 166	57B-96-08X 3-Sep-96 0 133	57B-96-08X 29-Aug-96 5 166	57B-96-08X 3-Sep-96 10 161
Analytes	**Reporting Limit 1995/1996**										
Vinyl Chloride	2 µg/kg/250 µg/kg	NA	NA	NA	NA	1400 U	1600 U	330 U	270 U	330 U	320 U
1,1-DCE	5 µg/kg/250 µg/kg	6.5 UJ	5.3 UJ	5.3 UJ	13 UJ	1400 U	1600 U	330 U	270 U	330 U	320 U
t-1,2-DCE	2 µg/kg/250 µg/kg	NA	NA	NA	NA	1400 U	1600 U	330 U	270 U	330 U	320 U
c-1,2-DCE	2 µg/kg/250 µg/kg	NA	NA	NA	NA	1400 U	1600 U	330 U	270 U	330 U	320 U
Chloroform	2 µg/kg/250 µg/kg	2.6 U	2.1 U	2.1 U	5.3 U	1400 U	1600 U	330 U	270 U	330 U	320 U
1,1,1-TCA	2 µg/kg/250 µg/kg	2.6 U	2.1 U	2.1 U	5.3 U	1400 U	1600 U	330 U	270 U	330 U	320 U
Carbon Tetrachloride	2 µg/kg/250 µg/kg	2.6 U	2.1 U	2.1 U	5.3 U	1400 U	1600 U	330 U	270 U	330 U	320 U
Trichloroethene	2 µg/kg/250 µg/kg	2.6 U	2.1 U	2.1 U	5.3 U	1400 U	1600 U	330 U	270 U	330 U	320 U
Tetrachloroethene	2 µg/kg/250 µg/kg	2.6 U	2.1 U	2.1 U	5.3 U	1400 U	1600 U	330 U	270 U	330 U	320 U
1,3-DCB	2 µg/kg/250 µg/kg	NA	NA	NA	NA	1400 U	1600 U	330 U	270 U	330 U	320 U
1,4-DCB	2 µg/kg/250 µg/kg	NA	NA	NA	NA	1400 U	14000	330 U	270 U	330 U	320 U
1,2-DCB	2 µg/kg/250 µg/kg	NA	NA	NA	NA	1400 U	46000	330 U	270 U	330 U	320 U
Benzene	2 µg/kg/250 µg/kg	2.6 U	2.1 U	2.1 U	5.3 U	1400 U	1600 U	330 U	270 U	330 U	320 U
Toluene	2 µg/kg/250 µg/kg	2.6 U	2.1 U	2.1 U	5.3 U	1400 U	1600 U	330 U	270 U	330 U	320 U
Chlorobenzene	2 µg/kg/250 µg/kg	49	2.1 U	2.1 U	5.3 U	1400 U	1600 U	330 U	270 U	330 U	320 U
Ethylbenzene	2 µg/kg/250 µg/kg	2.6 U	2.1 U	2.1 U	5.3 U	1400 U	11000	330 U	270 U	330 U	320 U
m/p-Xylene	4 µg/kg/540 µg/kg	5.2 U	4.2 U	4.2 U	11 U	2700 U	58000	730	530 U	660 U	640 U
o-Xylene	2 µg/kg/250 µg/kg	2.6 U	2.1 U	2.1 U	9.9	1400 U	28000	720	270 U	330 U	320 U
Naphthalene	2 µg/kg/250 µg/kg	NA	NA	NA	NA	2300 J	27000 J	440 J	270 U	330 U	320 U
TPH-DRO	100 mg/kg	NA	NA	110	130 U	NA	NA	NA	NA	NA	NA
TPH-GRO	100 µg/kg	130 U	110 U	4400 E	2100	NA	NA	NA	NA	NA	NA
TPH-IR (1995)	50 mg/kg	65 U	190	4500	180	NA	NA	NA	NA	NA	NA
TPH-IR (1996)	50 mg/kg	NA	NA	NA	NA	12000 E	14000 E	190	53	66 U	64 U

Notes:

U = Concentration is less than reporting limit
J = Value is estimated
E = Concentration exceeds the maximum reportin
NA = Not analyzed
B = Analyte found in method blank

TABLE 2-3
RI SOIL BORING AND TERRAPROBE FIELD ANALYTICAL RESULTS
AOC 57

FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MASSACHUSETTS

		AREA 3									
	Lab Sample ID:	57B-96-09X	57B-96-09X	57B-96-09X	57M-96-09X	57M-96-09X	57M-96-09X	57M-96-09X	57M-96-09X	57B-96-10X	57B-96-10X
	Date analyzed:	3-Sep-96	Aug-96	29-Aug-96	5-Sep-96	5-Sep-96	6-Sep-96	9-Sep-96	9-Sep-96	9-Sep-96	9-Sep-96
	Depth (bgs):	0	5	10	0	4	9	14	19	5	10
	Dilution:	130	153	174	133	130	131	158	160	131	163
Analytes	Reporting Limit 1995/1996										
Vinyl Chloride	2 μg/kg/250 μg/kg	260 U	310 U	350 U	270 U	260 U	260 U	320 U	320 U	260 U	330 U
1,1-DCE	5 μg/kg/250 μg/kg	260 U	310 U	370	270 UJ	260 UJ	260 U	320 U	320 U	260 U	330 U
t-1,2-DCE	2 μg/kg/250 μg/kg	260 U	310 U	350 U	270 U	260 U	260 U	320 U	320 U	260 U	330 U
c-1,2-DCE	2 μg/kg/250 μg/kg	260 U	310 U	350 U	270 U	260 U	260 U	320 U	320 U	260 U	330 U
Chloroform	2 μg/kg/250 μg/kg	260 U	310 U	350 U	270 U	260 U	260 U	320 U	320 U	260 U	330 U
1,1,1-TCA	2 μg/kg/250 μg/kg	260 U	310 U	350 U	270 U	260 U	260 U	320 U	320 U	260 U	330 U
Carbon Tetrachloride	2 μg/kg/250 μg/kg	260 U	310 U	350 U	270 U	260 U	260 U	320 U	320 U	260 U	330 U
Trichloroethene	2 μg/kg/250 μg/kg	260 U	310 U	350 U	270 U	260 U	260 U	320 U	320 U	260 U	330 U
Tetrachloroethene	2 μg/kg/250 μg/kg	260 U	310 U	350 U	270 U	260 U	260 U	320 U	320 U	260 U	330 U
1,3-DCB	2 μg/kg/250 μg/kg	260 U	310 U	350 U	270 U	260 U	260 U	320 U	320 U	260 U	330 U
1,4-DCB	2 μg/kg/250 μg/kg	260 U	310 U	350 U	270 U	260 U	260 U	320 U	320 U	260 U	330 U
1,2-DCB	2 μg/kg/250 μg/kg	260 U	310 U	350 U	270 U	260 U	260 U	320 U	320 U	260 U	330 U
Benzene	2 μg/kg/250 μg/kg	260 U	310 U	350 U	270 U	260 U	260 U	320 U	320 U	260 U	330 U
Toluene	2 μg/kg/250 μg/kg	260 U	310 U	350 U	270 U	260 U	260 U	320 U	320 U	260 U	330 U
Chlorobenzene	2 μg/kg/250 μg/kg	260 U	310 U	350 U	270 U	260 U	260 U	320 U	320 U	260 U	330 U
Ethylbenzene	2 μg/kg/250 μg/kg	260 U	310 U	350 U	270 U	260 U	260 U	320 U	320 U	260 U	330 U
m/p-Xylene	4 μg/kg/540 μg/kg	520 U	610 U	700 U	530 U	520 U	520 U	630 U	640 U	520 U	650 U
o-Xylene	2 μg/kg/250 μg/kg	260 U	310 U	350 U	270 U	260 U	260 U	320 U	320 U	260 U	330 U
Naphthalene	2 μg/kg/250 μg/kg	260 U	310 U	350 U	270 U	260 U	260 U	320 U	320 U	260 U	330 U
TPH-DRO	100 mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TPH-GRO	100 μg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TPH-IR (1995)	50 mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TPH-IR (1996)	50 mg/kg	150	61 U	70 U	53 U	52 U	52 U	63 U	64 U	52 U	65

Notes:

U = Concentration is less than reporting limit
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TABLE 2-3
RI SOIL BORING AND TERRAPROBE FIELD ANALYTICAL RESULTS
AOC 57

FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MASSACHUSETTS

		AREA 3									
	Lab Sample ID:	57B-96-10X	57B-96-11X	57B-96-11X	57B-96-11X	57B-96-11X	57B-96-12X	57R-95-06X	57R-96-07X	57R-96-07X	57R-96-07X
	Date analyzed:	Sep-96	10-Sep-96	10-Sep-96	10-Sep-96	10-Sep-96	10-Sep-96	11-Oct-95	21-Aug-96	21-Aug-96	21-Aug-96
	Depth (bgs):	15	5	10	10D	15	5	10	2	6	10
	Dilution:	175	136	155	161	163	1490	1.29	131	133	165
Analytes	Reporting Limit 1995/1996										
Vinyl Chloride	2 µg/kg/250 µg/kg	350 U	270 U	310 U	320 U	330 U	3000 U	NA	260 U	270 U	330 U
1,1-DCE	5 µg/kg/250 µg/kg	350 U	270 U	310 U	320 U	330 U	3000 U	6.5 UJ	260 U	270 U	330 U
t-1,2-DCE	2 µg/kg/250 µg/kg	350 U	270 U	310 U	320 U	330 U	3000 U	NA	260 U	270 U	330 U
c-1,2-DCE	2 µg/kg/250 µg/kg	350 U	270 U	310 U	320 U	330 U	3000 U	NA	260 U	270 U	330 U
Chloroform	2 µg/kg/250 µg/kg	350 U	270 U	310 U	320 U	330 U	3000 U	2.6 U	260 U	270 U	330 U
1,1,1-TCA	2 µg/kg/250 µg/kg	350 U	270 U	310 U	320 U	330 U	3000 U	2.6 U	260 U	270 U	330 U
Carbon Tetrachloride	2 µg/kg/250 µg/kg	350 U	270 U	310 U	320 U	330 U	3000 U	2.6 U	260 U	270 U	330 U
Trichloroethene	2 µg/kg/250 µg/kg	350 U	270 U	310 U	320 U	330 U	3000 U	2.6 U	260 U	270 U	330 U
Tetrachloroethene	2 µg/kg/250 µg/kg	350 U	270 U	310 U	320 U	330 U	3000 U	2.6 U	260 U	270 U	330 U
1,3-DCB	2 µg/kg/250 µg/kg	350 U	270 U	310 U	320 U	330 U	3000 U	NA	NA	NA	NA
1,4-DCB	2 µg/kg/250 µg/kg	350 U	270 U	310 U	320 U	330 U	3000 U	NA	NA	NA	NA
1,2-DCB	2 µg/kg/250 µg/kg	350 U	270 U	310 U	320 U	330 U	3000 U	NA	NA	NA	NA
Benzene	2 µg/kg/250 µg/kg	350 U	270 U	310 U	320 U	330 U	3000 U	2.6 U	260 U	270 U	330 U
Toluene	2 µg/kg/250 µg/kg	350 U	270 U	310 U	320 U	330 U	3000 U	2.6 U	260 U	270 U	330 U
Chlorobenzene	2 µg/kg/250 µg/kg	350 U	270 U	310 U	320 U	330 U	4700	2.6 U	260 U	270 U	330 U
Ethylbenzene	2 µg/kg/250 µg/kg	350 U	270 U	310 U	320 U	330 U	3000 U	2.6 U	260 U	270 U	330 U
m/p-Xylene	4 µg/kg/540 µg/kg	700 U	540 U	620 U	640 U	650 U	13000	5.2 U	520 U	530 U	660 U
o-Xylene	2 µg/kg/250 µg/kg	350 U	270 U	310 U	320 U	330 U	4700	2.6 U	260 U	270 U	330 U
Naphthalene	2 µg/kg/250 µg/kg	350 U	270 U	310 U	320 U	330 U	8300	NA	NA	NA	NA
TPH-DRO	100 mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TPH-GRO	100 µg/kg	NA	NA	NA	NA	NA	NA	130 U	NA	NA	NA
TPH-IR (1995)	50 mg/kg	NA	NA	NA	NA	NA	NA	65 U	NA	NA	NA
TPH-IR (1996)	50 mg/kg	70	7400	62 U	64 U	65 U	13000 E	NA	52 U	53 U	66

Notes:

U = Concentration is less than reporting limit
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B = Analyte found in method blank

TABLE 2-3
RI SOIL BORING AND TERRAPROBE FIELD ANALYTICAL RESULTS
AOC 57

FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MASSACHUSETTS

		AREA 3									
	Lab Sample ID:	57R-96-08X	57R-96-08X	57R-96-08X	57R-96-08X	57R-96-09X	57R-96-09X	57R-96-09X	57R-96-10X	57R-96-10X	57R-96-10X
	Date analyzed:	21-Aug-96	21-Aug-96	21-Aug-96	21-Aug-96	22-Aug-96	22-Aug-96	22-Aug-96	22-Aug-96	22-Aug-96	23-Aug-96
	Depth (bgs):	2	2D	6	10	2	6	10	2	6	10
	Dilution:	133	133	133	159	130	134	155	133	135	149
Analytes	**Reporting Limit 1995/1996**										
Vinyl Chloride	2 µg/kg/250 µg/kg	270 U	270 U	270 U	320 U	260 U	270 U	310 U	270 U	270 U	300 U
1,1-DCE	5 µg/kg/250 µg/kg	270 U	270 U	270 U	320 U	260 U	270 U	310 U	270 U	270 U	300 U
t-1,2-DCE	2 µg/kg/250 µg/kg	270 U	270 U	270 U	320 U	260 U	270 U	310 U	270 U	270 U	300 U
c-1,2-DCE	2 µg/kg/250 µg/kg	270 U	270 U	270 U	320 U	260 U	270 U	310 U	270 U	270 U	300 U
Chloroform	2 µg/kg/250 µg/kg	270 U	270 U	270 U	320 U	260 U	270 U	310 U	270 U	270 U	300 U
1,1,1-TCA	2 µg/kg/250 µg/kg	270 U	270 U	270 U	320 U	260 U	270 U	310 U	270 U	270 U	300 U
Carbon Tetrachloride	2 µg/kg/250 µg/kg	270 U	270 U	270 U	320 U	260 U	270 U	310 U	270 U	270 U	300 U
Trichloroethene	2 µg/kg/250 µg/kg	270 U	270 U	270 U	320 U	260 U	270 U	310 U	270 U	270 U	300 U
Tetrachloroethene	2 µg/kg/250 µg/kg	270 U	270 U	270 U	320 U	260 U	270 U	310 U	270 U	270 U	300 U
1,3-DCB	2 µg/kg/250 µg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,4-DCB	2 µg/kg/250 µg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2-DCB	2 µg/kg/250 µg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene	2 µg/kg/250 µg/kg	270 U	270 U	270 U	320 U	260 U	270 U	310 U	270 U	270 U	300 U
Toluene	2 µg/kg/250 µg/kg	270 U	270 U	270 U	320 U	260 U	270 U	310 U	270 U	270 U	300 U
Chlorobenzene	2 µg/kg/250 µg/kg	270 U	270 U	270 U	320 U	260 U	270 U	310 U	270 U	270 U	300 U
Ethylbenzene	2 µg/kg/250 µg/kg	270 U	270 U	270 U	320 U	260 U	270 U	310 U	270 U	270 U	300 U
m/p-Xylene	4 µg/kg/540 µg/kg	530 U	530 U	530 U	640 U	520 U	540 U	620 U	530 U	540 U	600 U
o-Xylene	2 µg/kg/250 µg/kg	270 U	270 U	270 U	320 U	260 U	270 U	310 U	270 U	270 U	1900
Naphthalene	2 µg/kg/250 µg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TPH-DRO	100 mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TPH-GRO	100 µg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TPH-IR (1995)	50 mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TPH-IR (1996)	50 mg/kg	53 U	NA	53 U	64 U	52 U	54 U	62	150	54 U	60

Notes:

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TABLE 2-3
RI SOIL BORING AND TERRAPROBE FIELD ANALYTICAL RESULTS
AOC 57

FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MASSACHUSETTS

		AREA 3									
	Lab Sample ID:	57R-96-10X	57R-96-11X	57R-96-11X	57R-96-11X	57R-96-12X	57R-96-12X	57R-96-12X	57R-96-12X	57R-96-13X	57R-96-13X
	Date analyzed:	23-Aug-96	23-Aug-96	23-Aug-96	23-Aug-96	23-Aug-96	23-Aug-96	23-Aug-96	26-Aug-96	26-Aug-96	27-Aug-96
	Depth (bgs):	10D	2	6	10	2	6	6D	10	3	5
	Dilution:	149	135	135	154	138	130	130	144	134	138
Analytes	**Reporting Limit 1995/1996**										
Vinyl Chloride	2 µg/kg/250 µg/kg	300 U	270 U	270 U	310 U	280 U	260 U	260 U	290 U	270 U	280 U
1,1-DCE	5 µg/kg/250 µg/kg	300 U	270 U	270 U	310 U	280 U	260 U	260 U	290 U	270 U	280 U
t-1,2-DCE	2 µg/kg/250 µg/kg	300 U	270 U	270 U	310 U	280 U	260 U	260 U	290 U	270 U	280 U
c-1,2-DCE	2 µg/kg/250 µg/kg	300 U	270 U	270 U	310 U	280 U	260 U	260 U	290 U	270 U	280 U
Chloroform	2 µg/kg/250 µg/kg	300 U	270 U	270 U	310 U	280 U	260 U	260 U	290 U	270 U	280 U
1,1,1-TCA	2 µg/kg/250 µg/kg	300 U	270 U	270 U	310 U	280 U	260 U	260 U	290 U	270 U	280 U
Carbon Tetrachloride	2 µg/kg/250 µg/kg	300 U	270 U	270 U	310 U	280 U	260 U	260 U	290 U	270 U	280 U
Trichloroethene	2 µg/kg/250 µg/kg	300 U	270 U	270 U	310 U	280 U	260 U	260 U	290 U	270 U	280 U
Tetrachloroethene	2 µg/kg/250 µg/kg	300 U	270 U	270 U	310 U	280 U	260 U	260 U	290 U	270 U	280 U
1,3-DCB	2 µg/kg/250 µg/kg	NA	NA	NA	NA	NA	NA	NA	290 U	270 U	280 U
1,4-DCB	2 µg/kg/250 µg/kg	NA	NA	NA	NA	NA	NA	NA	290 U	270 U	280 U
1,2-DCB	2 µg/kg/250 µg/kg	NA	NA	NA	NA	NA	NA	NA	290 U	270 U	280 U
Benzene	2 µg/kg/250 µg/kg	300 U	270 U	270 U	310 U	280 U	260 U	260 U	290 U	270 U	280 U
Toluene	2 µg/kg/250 µg/kg	300 U	270 U	270 U	310 U	280 U	260 U	260 U	290 U	270 U	280 U
Chlorobenzene	2 µg/kg/250 µg/kg	300	270 U	270 U	310 U	280 U	260 U	260 U	290 U	270 U	280 U
Ethylbenzene	2 µg/kg/250 µg/kg	300 U	270 U	270 U	310 U	280 U	260 U	260 U	290 U	270 U	270
m/p-Xylene	4 µg/kg/540 µg/kg	600 U	540 U	540 U	620 U	550 U	520 U	520 U	580 U	540 U	1300
o-Xylene	2 µg/kg/250 µg/kg	530	270 U	270 U	310 U	280 U	260 U	260 U	290 U	270 U	670
Naphthalene	2 µg/kg/250 µg/kg	NA	NA	NA	NA	NA	NA	NA	290 U	860	2200 J
TPH-DRO	100 mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TPH-GRO	100 µg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TPH-IR (1995)	50 mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TPH-IR (1996)	50 mg/kg	NA	150	260	62	150	52 U	52 U	58	9400 E	39000

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TABLE 2-3
RI SOIL BORING AND TERRAPROBE FIELD ANALYTICAL RESULTS
AOC 57

FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MASSACHUSETTS

		AREA 3									
	Lab Sample ID:	57R-96-13X	57R-96-14X	57R-96-14X	57R-96-14X	57R-96-15X	57R-96-15X	57R-96-15X	57R-96-16X	57R-96-16X	57R-96-16X
	Date analyzed:	27-Aug-96	26-Aug-96	26-Aug-96	26-Aug-96	28-Aug-96	28-Aug-96	29-Aug-96	29-Aug-96	29-Aug-96	29-Aug-96
	Depth (bgs):	9	3	5	9	3	5	9	3	3D	5
	Dilution:	166	136	161	160	268	675	780	131	131	141
Analytes	Reporting Limit 1995/1996										
Vinyl Chloride	2 µg/kg/250 µg/kg	330 U	270 U	320 U	320 U	540 U	1400 U	1600 U	260 U	260 U	280 U
1,1-DCE	5 µg/kg/250 µg/kg	330 U	270 U	320 U	320 U	540 U	1400 U	1600 U	260 U	260 U	280 U
t-1,2-DCE	2 µg/kg/250 µg/kg	330 U	270 U	320 U	320 U	540 U	1400 U	1600 U	260 U	260 U	280 U
c-1,2-DCE	2 µg/kg/250 µg/kg	330 U	270 U	320 U	320 U	540 U	1400 U	1600 U	260 U	260 U	280 U
Chloroform	2 µg/kg/250 µg/kg	330 U	270 U	320 U	320 U	540 U	1400 U	1800 B	380 B	260 U	280 U
1,1,1-TCA	2 µg/kg/250 µg/kg	330 U	270 U	320 U	320 U	540 U	1400 U	1600 U	260 U	260 U	280 U
Carbon Tetrachloride	2 µg/kg/250 µg/kg	330 U	270 U	320 U	320 U	540 U	1400 U	1600 U	260 U	260 U	280 U
Trichloroethene	2 µg/kg/250 µg/kg	330 U	270 U	320 U	320 U	540 U	1400 U	1600 U	260 U	260 U	280 U
Tetrachloroethene	2 µg/kg/250 µg/kg	330 U	270 U	320 U	320 U	540 U	1400 U	1600 U	260 U	260 U	280 U
1,3-DCB	2 µg/kg/250 µg/kg	330 U	270 U	320 U	320 U	540 U	1400 U	1600 U	260 U	260 U	280 U
1,4-DCB	2 µg/kg/250 µg/kg	330 U	270 U	320 U	320 U	540 U	1600	2200	260 U	260 U	280 U
1,2-DCB	2 µg/kg/250 µg/kg	330 U	270 U	320 U	320 U	540 U	3700	6300	260 U	260 U	280 U
Benzene	2 µg/kg/250 µg/kg	330 U	270 U	320 U	320 U	540 U	1400 U	1600 U	260 U	260 U	280 U
Toluene	2 µg/kg/250 µg/kg	330 U	270 U	320 U	320 U	540 U	1400 U	1600 U	260 U	260 U	280 U
Chlorobenzene	2 µg/kg/250 µg/kg	330 U	270 U	320 U	320 U	540 U	1400 U	1600 U	260 U	260 U	280 U
Ethylbenzene	2 µg/kg/250 µg/kg	330 U	270 U	320 U	320 U	540 U	1400 U	2100	260 U	260 U	280 U
m/p-Xylene	4 µg/kg/540 µg/kg	660 U	540 U	640 U	640 U	1100 U	4400	9000	520 U	520 U	560 U
o-Xylene	2 µg/kg/250 µg/kg	330 U	270 U	320 U	320 U	540 U	2600	6700	260 U	260 U	280 U
Naphthalene	2 µg/kg/250 µg/kg	330 U	1200	320 U	320 U	2000	7100	12000 J	260 U	930 J	280 U
TPH-DRO	100 mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TPH-GRO	100 µg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TPH-IR (1995)	50 mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TPH-IR (1996)	50 mg/kg	320	55	66 U	64	12000 E	12000 E	14000 E	53	53	57

Notes:

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B = Analyte found in method blank

TABLE 2-3
RI SOIL BORING AND TERRAPROBE FIELD ANALYTICAL RESULTS
AOC 57

FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MASSACHUSETTS

		AREA 3									
	Lab Sample ID: Date analyzed: Depth (bgs): Dilution:	57R-96-16X 3-Sep-96 9 164	57R-96-17X 4-Sep-96 3 129	57R-96-17X 4-Sep-96 5 134	57R-96-17X 4-Sep-96 9 161	57R-96-17X 4-Sep-96 9D 161	57R-96-18X 4-Sep-96 3 138	57R-96-18X 5-Sep-96 5 135	57R-96-18X 5-Sep-96 9 168	57R-96-19X 9-Sep-96 3 135	57R-96-19X 9-Sep-96 5 143
Analytes	**Reporting Limit 1995/1996**										
Vinyl Chloride	2 µg/kg/250 µg/kg	330 U	260 U	270 U	320 U	320 U	280 U	270 U	340 U	270 U	290 U
1,1-DCE	5 µg/kg/250 µg/kg	330 U	260 UJ	270 UJ	320 UJ	320 UJ	280 UJ	270 UJ	340 UJ	270 U	290 U
t-1,2-DCE	2 µg/kg/250 µg/kg	330 U	260 U	270 U	320 U	320 U	280 U	270 U	340 U	270 U	290 U
c-1,2-DCE	2 µg/kg/250 µg/kg	330 U	260 U	270 U	320 U	320 U	280 U	270 U	340 U	270 U	290 U
Chloroform	2 µg/kg/250 µg/kg	330 U	260 U	270 U	320 U	320 U	280 U	270 U	340 U	270 U	290 U
1,1,1-TCA	2 µg/kg/250 µg/kg	330 U	260 U	270 U	320 U	320 U	280 U	270 U	340 U	270 U	290 U
Carbon Tetrachloride	2 µg/kg/250 µg/kg	330 U	260 U	270 U	320 U	320 U	280 U	270 U	340 U	270 U	290 U
Trichloroethene	2 µg/kg/250 µg/kg	330 U	260 U	270 U	320 U	320 U	280 U	270 U	340 U	270 U	290 U
Tetrachloroethene	2 µg/kg/250 µg/kg	330 U	260 U	270 U	320 U	320 U	280 U	270 U	340 U	270 U	290 U
1,3-DCB	2 µg/kg/250 µg/kg	330 U	260 U	270 U	320 U	320 U	280 U	270 U	340 U	270 U	290 U
1,4-DCB	2 µg/kg/250 µg/kg	330 U	260 U	270 U	320 U	320 U	280 U	270 U	340 U	270 U	290 U
1,2-DCB	2 µg/kg/250 µg/kg	330 U	260 U	270 U	320 U	320 U	280 U	270 U	340 U	270 U	290 U
Benzene	2 µg/kg/250 µg/kg	330 U	260 U	270 U	320 U	320 U	280 U	270 U	340 U	270 U	290 U
Toluene	2 µg/kg/250 µg/kg	330 U	260 U	270 U	320 U	320 U	280 U	270 U	340 U	270 U	290 U
Chlorobenzene	2 µg/kg/250 µg/kg	330 U	260 U	270 U	320 U	320 U	280 U	270 U	340 U	270 U	290 U
Ethylbenzene	2 µg/kg/250 µg/kg	330 U	260 U	270 U	320 U	320 U	280 U	270 U	340 U	270 U	290 U
m/p-Xylene	4 µg/kg/540 µg/kg	660 U	520 U	540 U	640 U	640 U	550 U	540 U	670 U	540 U	570 U
o-Xylene	2 µg/kg/250 µg/kg	330 U	260 U	270 U	320 U	320 U	280 U	270 U	340 U	270 U	290 U
Naphthalene	2 µg/kg/250 µg/kg	330 U	260 U	270 U	320 U	320 U	280 U	270 U	340 U	270 U	290 U
TPH-DRO	100 mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TPH-GRO	100 µg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TPH-IR (1995)	50 mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TPH-IR (1996)	50 mg/kg	66	52 U	54 U	65	64 U	55	54 U	67 U	150	54 U

Notes:

U = Concentration is less than reporting limit
J = Value is estimated
E = Concentration exceeds the maximum reportin[
NA = Not analyzed
B = Analyte found in method blank

TABLE 2-3
RI SOIL BORING AND TERRAPROBE FIELD ANALYTICAL RESULTS
AOC 57

FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MASSACHUSETTS

		AREA 3				
	Lab Sample ID: Date analyzed: Depth (bgs): Dilution:	57R-96-19X 9-Sep-96 9 164	57R-96-20X 5-Sep-96 2 135	57R-96-20X 6-Sep-96 2D 135	57R-96-20X 9-Sep-96 6 131	57R-96-20X 9-Sep-96 10 250
Analytes	**Reporting Limit 1995/1996**					
Vinyl Chloride	2 µg/kg/250 µg/kg	330 U	270 U	270 U	260 U	500 U
1,1-DCE	5 µg/kg/250 µg/kg	330 U	270 UJ	270 U	260 U	500 U
t-1,2-DCE	2 µg/kg/250 µg/kg	330 U	270 U	270 U	260 U	500 U
c-1,2-DCE	2 µg/kg/250 µg/kg	330 U	270 U	270 U	260 U	500 U
Chloroform	2 µg/kg/250 µg/kg	330 U	340	270 U	260 U	500 U
1,1,1-TCA	2 µg/kg/250 µg/kg	330 U	270 U	270 U	260 U	500 U
Carbon Tetrachloride	2 µg/kg/250 µg/kg	330 U	270 U	270 U	260 U	500 U
Trichloroethene	2 µg/kg/250 µg/kg	330 U	270 U	270 U	260 U	500 U
Tetrachloroethene	2 µg/kg/250 µg/kg	330 U	270 U	270 U	260 U	500 U
1,3-DCB	2 µg/kg/250 µg/kg	330 U	270 U	270 U	260 U	500 U
1,4-DCB	2 µg/kg/250 µg/kg	330 U	270 U	270 U	260 U	500 U
1,2-DCB	2 µg/kg/250 µg/kg	510	270 U	270 U	260 U	500 U
Benzene	2 µg/kg/250 µg/kg	330 U	270 U	270 U	260 U	500 U
Toluene	2 µg/kg/250 µg/kg	370	270 U	270 U	260 U	500 U
Chlorobenzene	2 µg/kg/250 µg/kg	330 U	270 U	270 U	260 U	500 U
Ethylbenzene	2 µg/kg/250 µg/kg	670	270 U	270 U	260 U	500 U
m/p-Xylene	4 µg/kg/540 µg/kg	4500	540 U	540 U	520 U	1000 U
o-Xylene	2 µg/kg/250 µg/kg	1100	270 U	270 U	260 U	500 U
Naphthalene	2 µg/kg/250 µg/kg	1700	270 U	270 U	260 U	500 U
TPH-DRO	100 mg/kg	NA	NA	NA	NA	NA
TPH-GRO	100 µg/kg	NA	NA	NA	NA	NA
TPH-IR (1995)	50 mg/kg	NA	NA	NA	NA	NA
TPH-IR (1996)	50 mg/kg	700	54 U	54 U	52 U	200

Notes:

U = Concentration is less than reporting limit
J = Value is estimated
E = Concentration exceeds the maximum reportin
NA = Not analyzed
B = Analyte found in method blank

TABLE 2-4
RI SOIL OFF-SITE ANALYTICAL RESULTS
AOC 57

FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MASSACHUSETTS

Site ID: Field Sample Number: Lab Sample Number: Sample Date: Depth: Units:	Devens Background Concentrations mg/kg	AREA 2 57B-95-01X BX570100 DV4S*141 09/26/95 0 mg/kg		57B-95-01X BX570105 DV4S*142 09/26/95 5 mg/kg		57B-95-01X BX570121 DV4S*143 09/26/95 21 mg/kg		57B-95-02X BD570205 DV4S*441 09/27/95 5 mg/kg		57B-95-02X BX570200 DV4S*144 09/27/95 0 mg/kg	
METALS											
Aluminum	18000	7530	IM	4620	IM	2210	IM	3050	D IM	7500	IM
Antimony	0.5	< 1.09		< 1.09		< 1.09		< 1.09	D	< 1.09	
Arsenic	19	15		9.66		4.61		8.93	D	19	
Barium	54	40.9		17.6		8.86		8.62	D	18.9	
Beryllium	0.81	< .5		< .5		< .5		< .5	D	< .5	
Cadmium	1.28	< .7		< .7		< .7		< .7	D	< .7	
Calcium	810	700		477		258		227	D	158	
Chromium	33	27		14		< 4.05		6.39	D	13	
Cobalt	4.7	4.9		3.79		< 1.42		1.83	D	6.15	
Copper	13.5	11.6		8.42		3.13		4.76	D	12.2	
Iron	18000	13300		8080		4230		5970	D	13200	
Lead	48	10		2.96		1.62		2.96	D	10	
Magnesium	5500	3200		1930		893		1360	D	2560	
Manganese	380	240		187		70.4		86.4	D	481	
Nickel	14.6	19.5		12		3.64		7.23	D	18.5	
Potassium	2400	1170		742		381		325	D	583	
Selenium	--	< .25		< .25		< .25		< .25	D	< .25	
Silver	0.086	< .589		< .589		< .589		< .589	D	< .589	
Sodium	131	299		309		347		245	D	260	
Vanadium	32.3	15.5		8.5		< 3.39		4.9	D	11.1	
Zinc	43.9	26.4		19.8		< 8.03		13.6	D	25.8	
PESTICIDES/PCBS											
4,4'-dde		< .00765		< .00765		< .00765		< .00765	D	< .00765	
4,4'-ddt		< .00707		< .00707		< .00707		< .00707	D	< .00707	
Aldrin		< .00729		< .00729		< .00729		< .00729	D	< .00729	
Chlordane - Alpha		< .005	T	< .005	T	< .005	T	< .005	TD	< .005	T
Dieldrin		< .00629		< .00629		< .00629		< .00629	D	< .00629	
Endosulfan I		< .00602		< .00602		< .00602		< .00602	D	< .00602	
Heptachlor Epoxide		< .0062		< .0062		< .0062		< .0062	D	< .0062	
Pcb 1242		< .082	T	< .082	T	< .082	T	< .082	TD	< .082	T
Pcb 1248		< .082	T	< .082	T	< .082	T	< .082	TD	< .082	T
Pcb 1260		< .0804		< .0804		< .0804		< .0804	D	< .0804	
SVOCs											
1,2,4-trichlorobenzene		< .04		< .04		< .04		< .04	D	< .2	
1,2-dichlorobenzene		< .11		< .11		< .11		< .11	D	< .6	
1,4-dichlorobenzene		< .098		< .098		< .098		< .098	D	< .5	
2-methylnaphthalene		.43		< .049		< .049		< .049	D	.4	
Acenaphthene		< .036		< .036		< .036		< .036	D	< .2	
Chrysene		< .12		< .12		< .12		< .12	D	< .6	
Dibenzofuran		.16		< .035		< .035		< .035	D	< .2	
Fluoranthene		.097		< .068		< .068		< .068	D	< .3	
Fluorene		< .033		< .033		< .033		< .033	D	< .2	
Naphthalene		.42		< .037		< .037		< .037	D	.4	
Phenanthrene		.28		< .033		< .033		< .033	D	< .2	
Pyrene		.087		< .033		< .033		< .033	D	< .2	

TABLE 2-4
RI SOIL OFF-SITE ANALYTICAL RESULTS
AOC 57

FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MASSACHUSETTS

Site ID:	Devens Background Concentrations	57B-95-01X	57B-95-01X	57B-95-01X	57B-95-02X		57B-95-02X
Field Sample Number:		BX570100	BX570105	BX570121	BD570205		BX570200
Lab Sample Number:		DV4S*141	DV4S*142	DV4S*143	DV4S*441		DV4S*144
Sample Date:		09/26/95	09/26/95	09/26/95	09/27/95		09/27/95
Depth:		0	5	21	5		0
Units:	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg		mg/kg
Bis(2-ethylhexyl) Phthalate		2.7	< .62	< .62	< .62	D	< 3
Di-n-butyl Phthalate		< .061	< .061	< .061	< .061	D	< .3
TPH BY GC							
TPH MOTOR OIL PATTERN		NA	NA	NA	NA		NA
VOCs							
*1,2-dichloroethylenes (cis And Trans)		< .003	< .003	< .003	< .003	D	< .003
2-hexanone		< .032	< .032	< .032	< .032	D	< .032
Acetone		< .017	< .017	< .017	< .017	D	< .017
Chloroform		.00089	< .00087	< .00087	< .00087	D	< .00087
Dichloromethane		< .012	< .012	< .012	< .012	D	< .012
Ethylbenzene		< .0017	< .0017	< .0017	< .0017	D	< .0017
Tetrachloroethene		< .00081	< .00081	< .00081	< .00081	D	< .00081
Toluene		< .00078	< .00078	< .00078	< .00078	D	.0016
Trichloroethylene		< .0028	< .0028	< .0028	< .0028	D	< .0028
Trichlorofluoromethane		.017	.013	.014	< .0059	D	< .0059
Xylenes		< .0015	< .0015	< .0015	< .0015	D	< .0015
OTHER							
Total Organic Carbon							
Total Petroleum Hydrocarbons		81.3	26.4	44.6	138	D	7970

NOTES:
FLC = USAEC Flagging Code
DQ = Data Qualifier
< = Concentration was less than the certified reporting limit
D = Duplicate Sample
T = Non-target compound analyzed for and not detected (non-GC/MS method)
I = Interferences in the sample caused the quantitation and/or identification to be suspect
M = High duplicate spike not within control limits
C = Analysis was confirmed by a different column or technique
Z = Non-target analyte analyzed for and detected by non-GC/MS method
J = Value is estimated
= Exceeds established Devens background levels
NA = Not Analyzed

TABLE 2-4
RI SOIL OFF-SITE ANALYTICAL RESULTS
AOC 57

FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MASSACHUSETTS

Site ID: / Field Sample Number: / Lab Sample Number: / Sample Date: / Depth: / Units:	Devens Background Concentrations mg/kg	AREA 2									
		57B-95-02X / BX570205 / DV4S*145 / 09/27/95 / 5 / mg/kg		57B-95-02X / BX570217 / DV4S*146 / 09/27/95 / 17 / mg/kg		57B-95-03X / BX570319 / DV4S*147 / 09/27/95 / 19 / mg/kg		57B-95-04X / BX570415 / DV4S*150 / 09/28/95 / 15 / mg/kg		57B-95-05X / BX570515 / DV4S*151 / 09/28/95 / 15 / mg/kg	
METALS											
Aluminum	18000	3800	IM	2470	IM	2220	IM	2500	IM	2910	IM
Antimony	0.5	< 1.09		< 1.09		< 1.09		< 1.09		< 1.09	
Arsenic	19	9.6		6.15		5.75		8.1		10.6	
Barium	54	11.1		7.55		6.91		10.7		< 5.18	
Beryllium	0.81	< .5		< .5		< .5		< .5		< .5	
Cadmium	1.28	< .7		< .7		< .7		< .7		< .7	
Calcium	810	264		208		319		276		325	
Chromium	33	8.38		< 4.05		< 4.05		< 4.05		< 4.05	
Cobalt	4.7	2.54		< 1.42		< 1.42		< 1.42		< 1.42	
Copper	13.5	5.76		3.74		4.33		3.93		3.9	
Iron	18000	7190		4740		4490		4560		5580	
Lead	48	2.76		1.98		3.93		2.09		1.72	
Magnesium	5500	1820		998		894		903		1170	
Manganese	380	118		87.1		79.1		135		76.2	
Nickel	14.6	8.35		5.16		4.2		5.57		4.58	
Potassium	2400	509		333		319		523		315	
Selenium	--	< .25		< .25		< .25		< .25		< .25	
Silver	0.086	< .589		< .589		< .589		< .589		< .589	
Sodium	131	263		313		297		373		304	
Vanadium	32.3	6.49		< 3.39		< 3.39		< 3.39		< 3.39	
Zinc	43.9	16.5		< 8.03		< 8.03		< 8.03		< 8.03	
PESTICIDES/PCBS											
4,4'-dde		< .00765		< .00765		< .00765		< .00765		< .00765	
4,4'-ddt		< .00707		< .00707		< .00707		< .00707		< .00707	
Aldrin		< .00729		< .00729		< .00729		< .00729		< .00729	
Chlordane - Alpha		< .005	T	< .005	T	< .005	T	< .005	T	< .005	T
Dieldrin		< .00629		< .00629		< .00629		< .00629		< .00629	
Endosulfan I		< .00602		< .00602		< .00602		< .00602		< .00602	
Heptachlor Epoxide		< .0062		< .0062		< .0062		< .0062		< .0062	
Pcb 1242		< .082	T	< .082	T	< .082	T	< .082	T	< .082	T
Pcb 1248		< .082	T	< .082	T	< .082	T	< .082	T	< .082	T
Pcb 1260		< .0804		< .0804		< .0804		< .0804		< .0804	
SVOCs											
1,2,4-trichlorobenzene		< .04		< .04		< .04		< .04		< .04	
1,2-dichlorobenzene		< .11		< .11		< .11		< .11		< .11	
1,4-dichlorobenzene		< .098		< .098		< .098		< .098		< .098	
2-methylnaphthalene		< .049		< .049		< .049		< .049		< .049	
Acenaphthene		< .036		< .036		< .036		< .036		< .036	
Chrysene		< .12		< .12		< .12		< .12		< .12	
Dibenzofuran		< .035		< .035		< .035		< .035		< .035	
Fluoranthene		< .068		< .068		< .068		< .068		< .068	
Fluorene		< .033		< .033		< .033		< .033		< .033	
Naphthalene		< .037		< .037		< .037		< .037		< .037	
Phenanthrene		< .033		< .033		< .033		< .033		< .033	
Pyrene		< .033		< .033		< .033		< .033		< .033	

TABLE 2-4
RI SOIL OFF-SITE ANALYTICAL RESULTS
AOC 57

FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MASSACHUSETTS

Site ID: Field Sample Number: Lab Sample Number: Sample Date: Depth: Units:	Devens Background Concentrations mg/kg	57B-95-02X BX570205 DV4S*145 09/27/95 5 mg/kg	57B-95-02X BX570217 DV4S*146 09/27/95 17 mg/kg	57B-95-03X BX570319 DV4S*147 09/27/95 19 mg/kg	57B-95-04X BX570415 DV4S*150 09/28/95 15 mg/kg	57B-95-05X BX570515 DV4S*151 09/28/95 15 mg/kg
Bis(2-ethylhexyl) Phthalate		< .62	< .62	< .62	< .62	< .62
Di-n-butyl Phthalate		< .061	< .061	< .061	< .061	< .061
TPH BY GC						
TPH MOTOR OIL PATTERN						
VOCs						
*1,2-dichloroethylenes (cis And Trans)		< .003	< .003	< .003	< .003	< .003
2-hexanone		< .032	< .032	< .032	< .032	< .032
Acetone		< .017	< .017	< .017	< .017	.025
Chloroform		< .00087	< .00087	< .00087	< .00087	< .00087
Dichloromethane		< .012	.049	.019	.033	< .012
Ethylbenzene		< .0017	< .0017	< .0017	< .0017	< .0017
Tetrachloroethene		< .00081	< .00081	< .00081	< .00081	< .00081
Toluene		< .00078	.0014	.0045	< .00078	.0037
Trichloroethylene		< .0028	< .0028	< .0028	< .0028	< .0028
Trichlorofluoromethane		< .0059	< .0059	< .0059	< .0059	.0068
Xylenes		< .0015	< .0015	< .0015	< .0015	< .0015
OTHER						
Total Organic Carbon						
Total Petroleum Hydrocarbons		87	< 27.6	52.7	< 27.8	< 27.6

NOTES:
FLC = USAEC Flagging Code
DQ = Data Qualifier
< = Concentration was less than the certified reporting limit

T = Non-target compound analyzed for and not detected (non-GC/MS method)
I = Interferences in the sample caused the quantitation and/or identification to be suspect
M = High duplicate spike not within control limits
C = Analysis was confirmed by a different column or technique
Z = Non-target analyte analyzed for and detected by non-GC/MS method
J = Value is estimated
= Exceeds established Devens background levels

TABLE 2-4
RI SOIL OFF-SITE ANALYTICAL RESULTS
AOC 57

FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MASSACHUSETTS

		AREA 2							
Site ID: / Field Sample Number: / Lab Sample Number: / Sample Date: / Depth: / Units:	Devens Background Concentrations mg/kg	57B-95-06X / BX570612 / DV4S*152 / 09/28/95 / 12 / mg/kg		57E-95-01X / EX570106 / DV4S*101 / 09/18/95 / 0 / mg/kg		57E-95-02X / EX570200 / DV4S*102 / 09/18/95 / 0 / mg/kg		57E-95-04X / ED570405 / DV4S*436 / 09/19/95 / 5 / mg/kg	
METALS									
Aluminum	18000	2860	IM	2590		3920		2730	D
Antimony	0.5	< 1.09		< 1.09		< 1.09		< 1.09	D
Arsenic	19	7.49		9.87		9.73		10.7	D
Barium	54	11.5		7.05		32.1		11.3	D
Beryllium	0.81	< .5		< .5		< .5		< .5	D
Cadmium	1.28	< .7		< .7		< .7		< .7	D
Calcium	810	384		400		580		176	D
Chromium	33	< 4.05		< 4.05		8.94		< 4.05	D
Cobalt	4.7	2.25		2.73		2.76		1.82	D
Copper	13.5	4.4		4.14		11.6		3.26	D
Iron	18000	5420		4640		8420		4550	D
Lead	48	1.8		2.02		22.9		1.81	D
Magnesium	5500	1040		773		1140		848	D
Manganese	380	79.4		68.1		79.2		226	D
Nickel	14.6	5.99		5.55		8.5		5.15	D
Potassium	2400	422		356		427		428	D
Selenium	--	< .25		< .25		.883		< .25	D
Silver	0.086	< .589		< .589		< .589		< .589	D
Sodium	131	328		185		436		286	D
Vanadium	32.3	4.66		< 3.39		11.1		4.37	D
Zinc	43.9	11.6		< 8.03		17.2		10	D
PESTICIDES/PCBS									
4,4'-dde		< .00765		< .00765		.0199	C	< .00765	D
4,4'-ddt		< .00707		< .00707		.0257	C	< .00707	D
Aldrin		< .00729		< .00729		< .00729		< .00729	D
Chlordane - Alpha		< .005	T	< .005	T	< .005	T	< .005	TD
Dieldrin		< .00629		< .00629		< .00629		< .00629	D
Endosulfan I		< .00602		< .00602		< .00602		< .00602	D
Heptachlor Epoxide		< .0062		< .0062		< .0062		< .0062	D
Pcb 1242		< .082	T	< .082	T	< .082	T	< .082	TD
Pcb 1248		< .082	T	< .082	T	< .082	T	< .082	TD
Pcb 1260		< .0804		< .0804		< .0804		< .0804	D
SVOCs									
1,2,4-trichlorobenzene		< .04		< .04		< .2		< .04	D
1,2-dichlorobenzene		< .11		< .11		< .6		< .11	D
1,4-dichlorobenzene		< .098		< .098		< .5		< .098	D
2-methylnaphthalene		< .049		< .049		< .2		< .049	D
Acenaphthene		< .036		< .036		< .2		< .036	D
Chrysene		< .12		< .12		< .6		< .12	D
Dibenzofuran		< .035		< .035		< .2		< .035	D
Fluoranthene		< .068		< .068		< .3		< .068	D
Fluorene		< .033		< .033		< .2		< .033	D
Naphthalene		< .037		< .037		< .2		< .037	D
Phenanthrene		< .033		< .033		.2		< .033	D
Pyrene		< .033		< .033		.4		< .033	D

TABLE 2-4
RI SOIL OFF-SITE ANALYTICAL RESULTS
AOC 57

FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MASSACHUSETTS

Site ID: / Field Sample Number: / Lab Sample Number: / Sample Date: / Depth: / Units:	Devens Background Concentrations mg/kg	57B-95-06X / BX570612 / DV4S*152 / 09/28/95 / 12 / mg/kg	57E-95-01X / EX570106 / DV4S*101 / 09/18/95 / 0 / mg/kg	57E-95-02X / EX570200 / DV4S*102 / 09/18/95 / 0 / mg/kg	57E-95-04X / ED570405 / DV4S*436 / 09/19/95 / 5 / mg/kg	
Bis(2-ethylhexyl) Phthalate		< .62	< .62	< 3	< .62	D
Di-n-butyl Phthalate		< .061	< .061	< .3	< .061	D
TPH BY GC						
TPH MOTOR OIL PATTERN			NA	NA	NA	
VOCs						
*1,2-dichloroethylenes (cis And Trans)		< .003	< .003	< .003	< .003	D
2-hexanone		< .032	< .032	< .032	< .032	D
Acetone		< .017	< .017	< .017	< .017	D
Chloroform		< .00087	< .00087	< .00087	< .00087	D
Dichloromethane		< .012	< .012	< .012	< .012	D
Ethylbenzene		< .0017	< .0017	.0024	< .0017	D
Tetrachloroethene		< .00081	< .00081	< .00081	< .00081	D
Toluene		< .00078	< .00078	.0025	< .00078	D
Trichloroethylene		< .0028	< .0028	< .0028	< .0028	D
Trichlorofluoromethane		.008	.0057	< .0059	< .0059	D
Xylenes		< .0015	< .0015	.029	< .0015	D
OTHER						
Total Organic Carbon						
Total Petroleum Hydrocarbons		< 27.6	141	454	23.6	D

NOTES:
FLC = USAEC Flagging Code
DQ = Data Qualifier
< = Concentration was less than the certified reporting limit

T = Non-target compound analyzed for and not detected (non-GC/MS method)
I = Interferences in the sample caused the quantitation and/or identification to be suspect
M = High duplicate spike not within control limits
C = Analysis was confirmed by a different column or technique
Z = Non-target analyte analyzed for and detected by non-GC/MS method
J = Value is estimated
= Exceeds established Devens background levels

TABLE 2-4
RI SOIL OFF-SITE ANALYTICAL RESULTS
AOC 57

FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MASSACHUSETTS

		AREA 2				
Site ID:		57E-95-04X	57E-95-05X	57E-95-07X	57E-95-08X	57E-95-09X
Field Sample Number:		EX570405	EX570506	EX570704	EX570804	EX570905
Lab Sample Number:	Devens Background Concentrations	DV4S*104	DV4S*105	DV4S*107	DV4S*108	DV4S*109
Sample Date:		09/19/95	09/19/95	09/19/95	09/20/95	09/20/95
Depth:		5	6	4	4	5
Units:	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
METALS						
Aluminum	18000	2750	4720	4810	3990	2700
Antimony	0.5	< 1.09	< 1.09	< 1.09	< 1.09	< 1.09
Arsenic	19	9.68	11	3.5	11	4.38
Barium	54	10.2	17.2	34.7	52.9	17.1
Beryllium	0.81	< .5	< .5	< .5	< .5	< .5
Cadmium	1.28	< .7	< .7	< .7	< .7	< .7
Calcium	810	205	325	1190	746	610
Chromium	33	< 4.05	11.5	< 4.05	< 4.05	< 4.05
Cobalt	4.7	1.67	3.87	2.61	< 1.42	< 1.42
Copper	13.5	3.33	7.49	8.13	4.41	1.97
Iron	18000	4300	7080	5910	2380	1980
Lead	48	1.83	4.62	34.6	188	6.87
Magnesium	5500	896	1670	518	243	186
Manganese	380	231	333	175	25.5	18.7
Nickel	14.6	5.05	9.34	5.48	4.19	< 1.71
Potassium	2400	344	606	156	268	197
Selenium	--	< .25	< .25	.645	1.22	.669
Silver	0.086	< .589	< .589	< .589	< .589	< .589
Sodium	131	283	426	433	726	470
Vanadium	32.3	3.77	8.07	< 3.39	9.79	< 3.39
Zinc	43.9	9.76	14.9	30.4	52.6	< 8.03
PESTICIDES/PCBS						
4,4'-dde		< .00765	< .00765	< .00765	< .00765	< .00765
4,4'-ddt		< .00707	< .00707	< .00707	< .00707	< .00707
Aldrin		< .00729	< .00729	< .00729	< .00729	< .00729
Chlordane - Alpha		< .005 T	< .005 T	< .005 T	< .005 T	< .005 T
Dieldrin		< .00629	< .00629	< .00629	< .00629	< .00629
Endosulfan I		< .00602	< .00602	< .00602	< .00602	< .00602
Heptachlor Epoxide		< .0062	< .0062	< .0062	< .0062	< .0062
Pcb 1242		< .082 T	< .082 T	< .082 T	< .082 T	< .082 T
Pcb 1248		< .082 T	< .082 T	< .082 T	< .082 T	< .082 T
Pcb 1260		< .0804	< .0804	< .0804	< .0804	< .0804
SVOCs						
1,2,4-trichlorobenzene		< .04	< .04	< .4	< .04	< .2
1,2-dichlorobenzene		< .11	< .11	< 1	< .11	< .6
1,4-dichlorobenzene		< .098	< .098	< 1	< .098	< .5
2-methylnaphthalene		< .049	< .049	6	< .049	< .2
Acenaphthene		< .036	< .036	< .4	< .036	< .2
Chrysene		< .12	< .12	< 1	< .12	< .6
Dibenzofuran		< .035	< .035	< .4	< .035	< .2
Fluoranthene		< .068	< .068	< .7	< .068	.7
Fluorene		< .033	< .033	< .3	< .033	< .2
Naphthalene		< .037	< .037	6	< .037	< .2
Phenanthrene		< .033	< .033	< .3	< .033	.3
Pyrene		< .033	< .033	< .3	< .033	.6

TABLE 2-4
RI SOIL OFF-SITE ANALYTICAL RESULTS
AOC 57

FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MASSACHUSETTS

Site ID: Field Sample Number: Lab Sample Number: Sample Date: Depth: Units:	Devens Background Concentrations mg/kg	57E-95-04X EX570405 DV4S*104 09/19/95 5 mg/kg	57E-95-05X EX570506 DV4S*105 09/19/95 6 mg/kg	57E-95-07X EX570704 DV4S*107 09/19/95 4 mg/kg	57E-95-08X EX570804 DV4S*108 09/20/95 4 mg/kg	57E-95-09X EX570905 DV4S*109 09/20/95 5 mg/kg
Bis(2-ethylhexyl) Phthalate		< .62	< .62	< 6	< .62	< 3
Di-n-butyl Phthalate		< .061	< .061	< .6	< .061	< .3
TPH BY GC						
TPH MOTOR OIL PATTERN		NA	NA	NA	NA	NA
VOCs						
*1,2-dichloroethylenes (cis And Trans)		< .003	< .003	.0039	< .003	< .003
2-hexanone		< .032	< .032	< .032	< .032	< .032
Acetone		< .017	< .017	< .017	< .017	< .017
Chloroform		< .00087	< .00087	< .00087	< .00087	< .00087
Dichloromethane		< .012	< .012	< .012	< .012	< .012
Ethylbenzene		< .0017	< .0017	.051	< .0017	< .0017
Tetrachloroethene		< .00081	< .00081	.0059	< .00081	< .00081
Toluene		< .00078	< .00078	.023	< .00078	< .00078
Trichloroethylene		< .0028	< .0028	.011	< .0028	< .0028
Trichlorofluoromethane		.0083	.007	< .0059	< .0059	< .0059
Xylenes		< .0015	< .0015	.27	< .0015	< .0015
OTHER						
Total Organic Carbon						
Total Petroleum Hydrocarbons		< 27.6	< 20.7	31800	57.6	79.2

NOTES:
FLC = USAEC Flagging Code
DQ = Data Qualifier
< = Concentration was less than the certified reporting limit

T = Non-target compound analyzed for and not detected (non-GC/MS method)
I = Interferences in the sample caused the quantitation and/or identification to be suspect
M = High duplicate spike not within control limits
C = Analysis was confirmed by a different column or technique
Z = Non-target analyte analyzed for and detected by non-GC/MS method
J = Value is estimated
= Exceeds established Devens background levels

TABLE 2-4
RI SOIL OFF-SITE ANALYTICAL RESULTS
AOC 57

FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MASSACHUSETTS

		AREA 2									
Site ID: Field Sample Number: Lab Sample Number: Sample Date: Depth: Units:	Devens Background Concentrations mg/kg	57E-95-10X EX571000 DV4S*110 09/19/95 0 mg/kg		57E-95-12X EX571200 DV4S*112 09/20/95 0 mg/kg		57E-95-13X EX571305 DV4S*113 09/21/95 .5 mg/kg		57E-95-14X EX571406 DV4S*114 09/21/95 6 mg/kg		57E-95-15X EX571502 DV4S*115 09/21/95 2 mg/kg	
METALS											
Aluminum	18000	7100		6180		4630		2960		9720	
Antimony	0.5	< 1.09		< 1.09		< 1.09		< 1.09		< 1.09	
Arsenic	19	7.86		9.54		21		18		2.14	
Barium	54	18.8		25.9		22.1		< 5.18		37.1	
Beryllium	0.81	.705		< .5		< .5		< .5		< .5	
Cadmium	1.28	< .7		< .7		< .7		< .7		< .7	
Calcium	810	134		255		846		261		595	
Chromium	33	7.69		13.6		2410		< 4.05		10.4	
Cobalt	4.7	1.86		1.93		4.7		2.43		< 1.42	
Copper	13.5	4.14		12.4		5.7		4.51		9.36	
Iron	18000	7030		7920		6690		5940		4910	
Lead	48	8.05		225		5060		2.26		76.2	
Magnesium	5500	926		1150		1400		1020		808	
Manganese	380	274		97.2		76.5		66.8		51.9	
Nickel	14.6	6.61		7.35		6.3		6.16		5.78	
Potassium	2400	144		327		309		386		300	
Selenium	--	< .25		< .25		< .25		< .25		569	
Silver	0.086	< .589		< .589		< .589		< .589		< .589	
Sodium	131	337		446		335		410		725	
Vanadium	32.3	7.58		14		7.6		< 3.39		11.9	
Zinc	43.9	13.7		22.7		753		< 8.03		42.9	
PESTICIDES/PCBS											
4,4'-dde		< .00765		< .00765		< .00765		< .00765		< .00765	
4,4'-ddt		< .00707		< .00707		< .00707		< .00707		< .00707	
Aldrin		< .00729		< .00729		< .00729		< .00729		< .00729	
Chlordane - Alpha		< .005	T	< .005	T	< .005	T	< .005	T	< .005	T
Dieldrin		< .00629		.0192	C	< .00629		< .00629		.0115	C
Endosulfan I		< .00602		< .00602		< .00602		< .00602		< .00602	
Heptachlor Epoxide		< .0062		< .0062		< .0062		< .0062		< .0062	
Pcb 1242		< .082	T	< .082	T	< .082	T	< .082	T	< .082	T
Pcb 1248		< .082	T	< .082	T	< .082	T	< .082	T	< .082	T
Pcb 1260		< .0804		4.2	C	< .0804		< .0804		7.3	C
SVOCs											
1,2,4-trichlorobenzene		< .04		< .4		< .04		< .04		< .8	
1,2-dichlorobenzene		< .11		< 1		< .11		< .11		< 2	
1,4-dichlorobenzene		< .098		< 1		< .098		< .098		< 2	
2-methylnaphthalene		< .049		< .5		< .049		< .049		< 1	
Acenaphthene		< .036		< .4		< .036		< .036		< .7	
Chrysene		< .12		< 1		< .12		< .12		< 2	
Dibenzofuran		< .035		< .4		< .035		< .035		< .7	
Fluoranthene		.11		< .7		< .068		< .068		< 1	
Fluorene		< .033		< .3		< .033		< .033		< .7	
Naphthalene		< .037		< .4		< .037		< .037		< .7	
Phenanthrene		.045		< .3		< .033		< .033		< .7	
Pyrene		.12		< .3		< .033		< .033		< .7	

TABLE 2-4
RI SOIL OFF-SITE ANALYTICAL RESULTS
AOC 57

FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MASSACHUSETTS

Site ID: / Field Sample Number: / Lab Sample Number: / Sample Date: / Depth: / Units:	Devens Background Concentrations mg/kg	57E-95-10X / EX571000 / DV4S*110 / 09/19/95 / 0 / mg/kg	57E-95-12X / EX571200 / DV4S*112 / 09/20/95 / 0 / mg/kg	57E-95-13X / EX571305 / DV4S*113 / 09/21/95 / 5 / mg/kg	57E-95-14X / EX571406 / DV4S*114 / 09/21/95 / 6 / mg/kg	57E-95-15X / EX571502 / DV4S*115 / 09/21/95 / 2 / mg/kg
Bis(2-ethylhexyl) Phthalate		< .62	< 6	< .62	< .62	< 10
Di-n-butyl Phthalate		< .061	< .6	< .061	< .061	< 1
TPH BY GC						
TPH MOTOR OIL PATTERN		NA	NA	NA	NA	NA
VOCs						
*1,2-dichloroethylenes (cis And Trans)		< .003	< .003	< .003	< .003	< .003
2-hexanone		< .032	< .032	< .032	< .032	< .032
Acetone		< .017	< .017	< .017	.037	< .017
Chloroform		< .00087	< .00087	< .00087	< .00087	< .00087
Dichloromethane		< .012	< .012	< .012	< .012	< .012
Ethylbenzene		< .0017	< .0017	< .0017	< .0017	< .0017
Tetrachloroethene		.003	.0011	< .00081	< .00081	.0023
Toluene		.0037	.0083	< .00078	< .00078	.0017
Trichloroethylene		< .0028	< .0028	< .0028	< .0028	< .0028
Trichlorofluoromethane		.0074	.0073	< .0059	< .0059	< .0059
Xylenes		< .0015	< .0015	< .0015	< .0015	< .0015
OTHER						
Total Organic Carbon						
Total Petroleum Hydrocarbons		25	5110	< 27.6	49.3	26100

NOTES:
FLC = USAEC Flagging Code
DQ = Data Qualifier
< = Concentration was less than the certified reporting limit

T = Non-target compound analyzed for and not detected (non-GC/MS method)
I = Interferences in the sample caused the quantitation and/or identification to be suspect
M = High duplicate spike not within control limits
C = Analysis was confirmed by a different column or technique
Z = Non-target analyte analyzed for and detected by non-GC/MS method
J = Value is estimated
[shaded] = Exceeds established Devens background levels

TABLE 2-4
RI SOIL OFF-SITE ANALYTICAL RESULTS
AOC 57

FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MASSACHUSETTS

		AREA 2				
Site ID: Field Sample Number: Lab Sample Number: Sample Date: Depth: Units:	Devens Background Concentrations mg/kg	57E-95-16X EX571600 DV4S*121 09/21/95 0 mg/kg	57E-95-16X EX571602 DV4S*116 09/21/95 2 mg/kg	57E-95-17X EX571700 DV4S*117 09/21/95 0 mg/kg	57E-95-18X EX571802 DV4S*118 09/21/95 2 mg/kg	57E-95-19X EX571902 DV4S*119 09/21/95 2 mg/kg
METALS						
Aluminum	18000	3140 IM	4430	5460	9940	3530
Antimony	0.5	< 1.09	< 1.09	1.62	< 1.09	< 1.09
Arsenic	19	7.06	12.7	9.06	10.6	1.71
Barium	54	13.6	116	37.5	< 5.18	< 5.18
Beryllium	0.81	< .5	< .5	.708	< .5	< .5
Cadmium	1.28	< .7	< .7	< .7	< .7	< .7
Calcium	810	414	659	528	< 100	< 100
Chromium	33	8.96	35.6	15.4	8.94	< 4.05
Cobalt	4.7	2.09	< 1.42	2.31	< 1.42	< 1.42
Copper	13.5	6.72	17.6	14.4	2.87	< .965
Iron	18000	5390	6880	7190	6370	762
Lead	48	40.5	224	110	4.62	4.15
Magnesium	5500	1120	633	1390	739	< 100
Manganese	380	74.9	72.7	138	34.8	3.95
Nickel	14.6	6.09	5.76	10.4	6.12	< 1.71
Potassium	2400	345	257	460	197	< 100
Selenium	--	< .25	1.1	.449	< .25	.652
Silver	0.086	< .589	.959	< .589	< .589	< .589
Sodium	131	294	661	346	404	560
Vanadium	32.3	5.65	9.58	12.5	10.1	< 3.39
Zinc	43.9	23.2	66.7	41	< 8.03	< 8.03
PESTICIDES/PCBS						
4,4'-dde		< .00765	< .00765	.00928 C	< .00765	< .00765
4,4'-ddt		< .00707	< .00707	< .00707	< .00707	< .00707
Aldrin		< .00729	< .00729	< .00729	< .00729	< .00729
Chlordane - Alpha		< .005 T	< .005 T	< .005 T	< .005 T	< .005 T
Dieldrin		.0127 C	< .00629	.032 C	< .00629	< .00629
Endosulfan I		< .00602	.081 C	< .00602	< .00602	< .00602
Heptachlor Epoxide		< .0062	< .0062	< .0062	< .0062	< .0062
Pcb 1242		< .082 T	< .082 T	< .082 T	< .082 T	< .082 T
Pcb 1248		< .082 T	3.2 CZ	< .082 T	< .082 T	< .082 T
Pcb 1260		.188 C	12 C	.342 C	< .0804	< .0804
SVOCs						
1,2,4-trichlorobenzene		< .2	< 2	< .4	< .04	< .04
1,2-dichlorobenzene		< .6	< 4	< 1	< .11	< .11
1,4-dichlorobenzene		< .5	< 4	< 1	< .098	< .098
2-methylnaphthalene		< .2	< 2	< .5	< .049	< .049
Acenaphthene		< .2	< 1	< .4	< .036	< .036
Chrysene		< .6	< 5	< 1	< .12	< .12
Dibenzofuran		< .2	< 1	< .4	< .035	< .035
Fluoranthene		< .3	< 3	1	< .068	< .068
Fluorene		< .2	< 1	< .3	< .033	< .033
Naphthalene		< .2	< 1	< .4	< .037	< .037
Phenanthrene		< .2	< 1	.6	< .033	< .033
Pyrene		< .2	< 1	1	< .033	< .033

TABLE 2-4
RI SOIL OFF-SITE ANALYTICAL RESULTS
AOC 57

FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MASSACHUSETTS

Site ID: / Field Sample Number: / Lab Sample Number: / Sample Date: / Depth: / Units:	Devens Background Concentrations mg/kg	57E-95-16X EX571600 DV4S*121 09/21/95 0 mg/kg	57E-95-16X EX571602 DV4S*116 09/21/95 2 mg/kg	57E-95-17X EX571700 DV4S*117 09/21/95 0 mg/kg	57E-95-18X EX571802 DV4S*118 09/21/95 2 mg/kg	57E-95-19X EX571902 DV4S*119 09/21/95 2 mg/kg
Bis(2-ethylhexyl) Phthalate		< 3	< 20	< 6	< .62	< .62
Di-n-butyl Phthalate		< .3	< 2	2	< .061	< .061
TPH BY GC						
TPH MOTOR OIL PATTERN		NA	NA	NA	NA	NA
VOCs						
*1,2-dichloroethylenes (cis And Trans)		< .003	< .003	< .003	< .003	< .003
2-hexanone		< .032	< .032	< .032	< .032	< .032
Acetone		< .017	.067	< .017	.03	.034
Chloroform		< .00087	< .00087	< .00087	< .00087	< .00087
Dichloromethane		< .012	< .012	.015	< .012	< .012
Ethylbenzene		< .0017	.0058	< .0017	< .0017	< .0017
Tetrachloroethene		< .00081	< .00081	.0047	< .00081	< .00081
Toluene		< .00078	.011	.0072	< .00078	< .00078
Trichloroethylene		< .0028	< .0028	< .0028	< .0028	< .0028
Trichlorofluoromethane		.0084	< .0059	.014	< .0059	< .0059
Xylenes		< .0015	< .0015	< .0015	< .0015	< .0015
OTHER						
Total Organic Carbon						
Total Petroleum Hydrocarbons		169	30000	2390	49.5	130

NOTES:
FLC = USAEC Flagging Code
DQ = Data Qualifier
< = Concentration was less than the certified reporting limit

T = Non-target compound analyzed for and not detected (non-GC/MS method)
I = Interferences in the sample caused the quantitation and/or identification to be suspect
M = High duplicate spike not within control limits
C = Analysis was confirmed by a different column or technique
Z = Non-target analyte analyzed for and detected by non-GC/MS method
J = Value is estimated
= Exceeds established Devens background levels

E 2-4
ALYTICAL RESULTS
: 57

TY STUDY REPORT
SACHUSETTS

AREA 3							
57B-96-07X BX570700 DV4S*520 08/28/96 0 mg/kg		57B-96-07X BX570705 DV4S*521 08/28/96 5 mg/kg		57B-96-08X BX570800 DV4S*522 08/29/96 0 mg/kg		57B-96-08X BX570805 DV4S*523 08/29/96 5 mg/kg	
5350		3510		6370		4730	
1.09		< 1.09		< 1.09		< 1.09	
7.97		5.7		41		9.67	
54.8		13.5		29.3		16	
.5		< .5		< .5		< .5	
10.8		< .7		1.5		< .7	
295		624		283		957	
11.8		5.91		11.7		6.75	
1.42		< 1.42		3.23		< 1.42	
26.9		3.87		6.83		5.48	
5810		3970		8040		5960	
425		4.14	J	32.7		2.97	J
957		1040		1650		1170	
52.2		48.4		548		59.6	
9.19		5.64		11.1		6.38	
250		642		683		649	
.25		< .25		< .25		< .25	
.589		< .589		< .589		4.46	
425		489		435		555	
6.26		5.46		9.16		7.1	
159		12.1		28.5		18.3	
.00765		< .00765		< .00765		< .00765	
.00707		< .00707		< .00707		< .00707	
.00729		< .00729		< .00729		< .00729	
.005	T	< .005	T	< .005	T	< .005	T
.00629		< .00629		< .00629		< .00629	
.00602		< .00602		< .00602		< .00602	
.0062		< .0062		< .0062		< .0062	
3.4	CZ	2.6	ZC	< .082	T	< .082	T
.082	T	< .082	T	< .082	T	< .082	T
8	C	6.1	C	< .0804		< .0804	
.4		.5		< .04		< .04	
1		8		< .11		< .11	
1		2		< .098		< .098	
.5		9		< .049		< .049	
.4		.5		< .036		< .036	
1		< .6		< .12		< .12	
.4		< .2		< .035		< .035	
.7		< .3		< .068		< .068	
.3		.5		< .033		< .033	
.4		9		< .037		< .037	
.3		1		< .033		< .033	
.3		.8		< .033		< .033	

TABLE 2-4
RI SOIL OFF-SITE ANALYTICAL RESULTS
AOC 57

FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MASSACHUSETTS

Site ID: / Field Sample Number: / Lab Sample Number: / Sample Date: / Depth: / Units:	Devens Background Concentrations mg/kg	57E-95-20X / EX572005 / DV4S*120 / 09/21/95 / 5 / mg/kg	57E-95-25X / EX572500 / DV4S*125 / 09/22/95 / 0 / mg/kg	57B-96-07X / BX570700 / DV4S*520 / 08/28/96 / 0 / mg/kg	57B-96-07X / BX570705 / DV4S*521 / 08/28/96 / 5 / mg/kg	57B-96-08X / BX570800 / DV4S*522 / 08/29/96 / 0 / mg/kg	57B-96-08X / BX570805 / DV4S*523 / 08/29/96 / 5 / mg/kg
Bis(2-ethylhexyl) Phthalate		< .62	2	< 6	< 3	< .62	< .62
Di-n-butyl Phthalate		< .061	< .1	< .6	< .3	< .061	< .061
TPH BY GC							
TPH MOTOR OIL PATTERN		NA	NA	21500	8930	< 50	< 50
VOCs							
*1,2-dichloroethylenes (cis And Trans)		< .003	< .003	< .003	< 0.0085	< 0.0017	< 0.0017
2-hexanone		< .032	< .032	< .032	< 0.16	< 0.032	< 0.032
Acetone		< .017	< .017	< .017	< 0.085	< 0.017	< 0.017
Chloroform		< .00087	< .00087	< .00087	< 0.0044	< 0.00087	< 0.00087
Dichloromethane		< .012	< .012	< .012	< 0.012	< 0.012	< 0.012
Ethylbenzene		< .0017	< .0017	< .0017	< 1.2	< 0.0017	< 0.0017
Tetrachloroethene		< .00081	< .00081	.0057	< 0.0041	< 0.00081	< 0.00081
Toluene		< .00078	< .00078	< .00078	0.31	0.0061	< 0.00078
Trichloroethylene		< .0028	< .0028	< .0028	< 0.014	< 0.0028	< 0.0028
Trichlorofluoromethane		< .0059	.0073	< .0059	0.036	< 0.0059	< 0.0059
Xylenes		< .0015	< .0015	< .0015	22	< 0.0015	< 0.0015
OTHER							
Total Organic Carbon							
Total Petroleum Hydrocarbons		62.5	81.1	41400	31600	50	< 27.8

NOTES:
FLC = USAEC Flagging Code
DQ = Data Qualifier
< = Concentration was less than the certified reporting limit

T = Non-target compound analyzed for and not detected (non-GC/MS method)
I = Interferences in the sample caused the quantitation and/or identification to be suspect
M = High duplicate spike not within control limits
C = Analysis was confirmed by a different column or technique
Z = Non-target analyte analyzed for and detected by non-GC/MS method
J = Value is estimated
[shaded] = Exceeds established Devens background levels

TABLE 2-4
RI SOIL OFF-SITE ANALYTICAL RESULTS
AOC 57

FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MASSACHUSETTS

		AREA 3				
Site ID:	Devens	57B-96-09X	57B-96-09X	57B-96-10X	57B-96-10X	57B-96-11X
Field Sample Number:	Background	BX570900	BX570905	BX571005	BX571010	BD571110
Lab Sample Number:	Concentrations	DV4S*524	DV4S*525	DV4S*526	DV4S*527	DV4S*539
Sample Date:		08/29/96	08/29/96	09/03/96	09/03/96	09/03/96
Depth:		0	5	5	10	10
Units:	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
METALS						
Aluminum	18000	7100	5610	3700	3560	3370 D
Antimony	0.5	< 1.09	< 1.09	< 1.09	< 1.09	< 1.09 D
Arsenic	19	5.23	8.39	36	5.15	5.17 D
Barium	54	11.1	13.3	11.2	14.4	13.2 D
Beryllium	0.81	< .5	< .5	.674	.5	< .5 D
Cadmium	1.28	< .7	< .7	< .7	< .7	< .7 D
Calcium	810	< 100	292	164	1100	1380 D
Chromium	33	10.6	7.57	5.1	6.54	< 4.05 D
Cobalt	4.7	2.37	2.7	2.52	1.42	< 1.42 D
Copper	13.5	5.29	5.47	3.4	5.13	4.97 D
Iron	18000	7430	6410	6460	5430	5010 D
Lead	48	7.84 J	3.95 J	2.1 J	3.01 J	1.91 D J
Magnesium	5500	1540	1340	1020	1140	989 D
Manganese	380	88.6	65.2	81.3	54.6	56.1 D
Nickel	14.6	10.5	7.3	6.25	6	6.49 D
Potassium	2400	209	521	535	717	582 D
Selenium	--	< .25	< .25	< .25	< .25	< .25 D
Silver	0.086	< .589	1.12	< .589	< .589	< .589 D
Sodium	131	400	505	416	538	535 D
Vanadium	32.3	9.41	7.99	5.56	6.71	5.55 D
Zinc	43.9	16.7	17.8	14.4	12.9	14.9 D
PESTICIDES/PCBS						
4,4'-dde		.0081 C	< .00765	< .00765	< .00765	< .00765
4,4'-ddt		.0121 C	< .00707	< .00707	< .00707	< .00707
Aldrin		< .00729	< .00729	< .00729	< .00729	< .00729
Chlordane - Alpha		< .005 T	< .005 T	< .005 T	< .005 T	< .005 T
Dieldrin		< .00629	< .00629	< .00629	< .00629	< .00629
Endosulfan I		< .00602	< .00602	< .00602	< .00602	< .00602
Heptachlor Epoxide		< .0062	< .0062	< .0062	< .0062	< .0062
Pcb 1242		< .082 T	< .082 T	< .082 T	< .082 T	< .082 T
Pcb 1248		< .082 T	< .082 T	< .082 T	< .082 T	< .082 T
Pcb 1260		< .0804	< .0804	< .0804	< .0804	< .0804
SVOCs						
1,2,4-trichlorobenzene		< .04	< .04	< .04	< .04	< .04 D
1,2-dichlorobenzene		< .11	< .11	< .11	< .11	< .11 D
1,4-dichlorobenzene		< .098	< .098	< .098	< .098	< .098 D
2-methylnaphthalene		< .049	< .049	< .049	< .049	< .049 D
Acenaphthene		< .036	< .036	< .036	< .036	< .036 D
Chrysene		< .12	< .12	< .12	< .12	< .12 D
Dibenzofuran		< .035	< .035	< .035	< .035	< .035 D
Fluoranthene		.14	< .068	< .068	< .068	< .068 D
Fluorene		< .033	< .033	< .033	< .033	< .033 D
Naphthalene		.048	< .037	< .037	< .037	< .037 D
Phenanthrene		.11	< .033	< .033	< .033	< .033 D
Pyrene		.15	< .033	< .033	< .033	< .033 D

TABLE 2-4
RI SOIL OFF-SITE ANALYTICAL RESULTS
AOC 57

FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MASSACHUSETTS

Site ID: / Field Sample Number: / Lab Sample Number: / Sample Date: / Depth: / Units:	Devens Background Concentrations mg/kg		57B-96-09X / BX570900 / DV4S*524 / 08/29/96 / 0 / mg/kg		57B-96-09X / BX570905 / DV4S*525 / 08/29/96 / 5 / mg/kg		57B-96-10X / BX571005 / DV4S*526 / 09/03/96 / 5 / mg/kg		57B-96-10X / BX571010 / DV4S*527 / 09/03/96 / 10 / mg/kg		57B-96-11X / BD571110 / DV4S*539 / 09/03/96 / 10 / mg/kg	
Bis(2-ethylhexyl) Phthalate		<	.62	<	.62	<	.62	<	.62	<	.62	D
Di-n-butyl Phthalate		<	.061	<	.061	<	.061	<	.061	<	.061	D
TPH BY GC												
TPH MOTOR OIL PATTERN		<	50	<	50	<	52.1	<	63	<	63	
VOCs												
*1,2-dichloroethylenes (cis And Trans)		<	0.0017	<	0.0017	<	.003	<	.003	<	.003	D
2-hexanone		<	0.032	<	0.032	<	.032	<	.032	<	.032	D
Acetone		<	0.017	<	0.017	<	.017	<	.017	<	.017	D
Chloroform		<	0.00087	<	0.00087	<	.00087	<	.00087	<	.00087	D
Dichloromethane		<	0.012	<	0.012	<	.012	<	.012	<	.012	D
Ethylbenzene		<	0.0017	<	0.0017	<	.0017	<	.0017	<	.0017	D
Tetrachloroethene		<	0.00081	<	0.00081	<	.00081	<	.00081	<	.00081	D
Toluene		<	0.003	<	0.0012	<	.00078	<	.00078	<	.00078	D
Trichloroethylene		<	0.0028	<	0.0028	<	.0028	<	.0028	<	.0028	D
Trichlorofluoromethane		<	0.0059	<	0.0059	<	.0059	<	.0059	<	.0059	D
Xylenes		<	0.0015	<	0.0068	<	.0015	<	.0015	<	.0015	D
OTHER												
Total Organic Carbon												
Total Petroleum Hydrocarbons			39.4	<	27.8	<	27.6	<	27.8		35.4	D

NOTES:
FLC = USAEC Flagging Code
DQ = Data Qualifier
< = Concentration was less than the certified reporting limit

T = Non-target compound analyzed for and not detected (non-GC/MS method)
I = Interferences in the sample caused the quantitation and/or identification to be suspect
M = High duplicate spike not within control limits
C = Analysis was confirmed by a different column or technique
Z = Non-target analyte analyzed for and detected by non-GC/MS method
J = Value is estimated
= Exceeds established Devens background levels

TABLE 2-4
RI SOIL OFF-SITE ANALYTICAL RESULTS
AOC 57

FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MASSACHUSETTS

		AREA 3				
Site ID:		57B-96-11X	57B-96-11X	57E-95-24X	57E-96-28X	57E-96-29X
Field Sample Number:		BX571105	BX571110	EX572404	EX572810	EX572911
Lab Sample Number:	Devens	DV4S*528	DV4S*529	DV4S*124	DV4S*516	DV4S*517
Sample Date:	Background	09/03/96	09/03/96	09/22/95	08/19/96	08/20/96
Depth:	Concentrations	5	10	4	10	11
Units:	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
METALS						
Aluminum	18000	2790	3940	7550 IM	2420	2460
Antimony	0.5	< 1.09	< 1.09	2.89	< 1.09	< 1.09
Arsenic	19	16	4.8	9.79	6.26	6.41
Barium	54	14.8	15.5	46.6	14.2	9.68
Beryllium	0.81	< .5	< .5	< .5	< .5	< .5
Cadmium	1.28	< .7	< .7	5.14	< .7	< .7
Calcium	810	668	602	590	930	591
Chromium	33	< 4.05	6.04	19.6	< 4.05	< 4.05
Cobalt	4.7	< 1.42	1.97	< 1.42	< 1.42	< 1.42
Copper	13.5	4.92	4.26	28.3	4.34	3.87
Iron	18000	4910	4790	6010	2700	3920
Lead	48	13 J	2.05 J	181	4.33 J	1.91 J
Magnesium	5500	774	1190	1270	641	736
Manganese	380	40.8	57.8	43.4	31.7	43.5
Nickel	14.6	4	6.99	8.82	4.98	4.85
Potassium	2400	450	742	310	407	431
Selenium	--	< .25	< .25	< .25	< .25	< .25
Silver	0.086	< .589	< .589	< .589	< .589	< .589
Sodium	131	463	542	355	408	500
Vanadium	32.3	4.4	6.34	11.3	< 3.39	< 3.39
Zinc	43.9	11.5	16	62.5	15.5	19.4
PESTICIDES/PCBS						
4,4'-dde		0.017	< .00765	< .00765	< .00765	< .00765
4,4'-ddt		< .00707	< .00707	< .00707	< .00707	< .00707
Aldrin		< .00729	< .00729	.0255 C	< .00729	< .00729
Chlordane - Alpha		< .005 T	< .005 T	< .005 T	.0103 C	< .005 T
Dieldrin		< .00629	< .00629	< .00629	< .00629	< .00629
Endosulfan I		< .00602	< .00602	< .00602	< .00602	< .00602
Heptachlor Epoxide		< .0062	< .0062	< .0062	< .0062	< .0062
Pcb 1242		< .082 T	< .082 T	< .082 T	< .082 T	< .082 T
Pcb 1248		< .082 T	< .082 T	3.6 CZ	< .082 T	< .082 T
Pcb 1260		7.4	< .0804	10 C	1.7 C	.0998 C
SVOCs						
1,2,4-trichlorobenzene		< .2	< .04	< 3	.5	< .04
1,2-dichlorobenzene		< .6	< .11	< 9	6	< .11
1,4-dichlorobenzene		< .5	< .098	< 8	4	< .098
2-methylnaphthalene		< .2	< .049	< 4	.4	< .049
Acenaphthene		< .2	< .036	< 3	< .2	< .036
Chrysene		< .6	< .12	< 10	1	< .12
Dibenzofuran		< .2	< .035	< 3	< .2	< .035
Fluoranthene		< .3	< .068	< 5	1	< .068
Fluorene		< .2	< .033	< 3	.3	< .033
Naphthalene		< .2	< .037	< 3	2	< .037
Phenanthrene		< .2	< .033	< 3	.4	< .033
Pyrene		< .2	< .033	< 3	3	.055

TABLE 2-4
RI SOIL OFF-SITE ANALYTICAL RESULTS
AOC 57

FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MASSACHUSETTS

Site ID: Field Sample Number: Lab Sample Number: Sample Date: Depth: Units:	Devens Background Concentrations mg/kg	57B-96-11X BX571105 DV4S*528 09/03/96 5 mg/kg	57B-96-11X BX571110 DV4S*529 09/03/96 10 mg/kg	57E-95-24X EX572404 DV4S*124 09/22/95 4 mg/kg	57E-96-28X EX572810 DV4S*516 08/19/96 10 mg/kg	57E-96-29X EX572911 DV4S*517 08/20/96 11 mg/kg
Bis(2-ethylhexyl) Phthalate		< 3	< .62	< 50	< 3	< .62
Di-n-butyl Phthalate		< .3	< .061	< 5	< .3	< .061
TPH BY GC						
TPH MOTOR OIL PATTERN		< 2240	< 61	NA	19700	286
VOCs						
*1,2-dichloroethylenes (cis And Trans)		< .003	< .003	< .003	< .003	< .003
2-hexanone		< .032	< .032	< .032	.03	< .032
Acetone		< .017	< .017	< .017	< .017	< .017
Chloroform		< .00087	< .00087	< .00087	< .00087	< .00087
Dichloromethane		< .012	< .012	< .012	< .012	< .012
Ethylbenzene		< .0017	< .0017	< .0017	.0042	< .0017
Tetrachloroethene		< .00081	< .00081	.0018	.0094	< .00081
Toluene		< .00078	.0018	< .00078	< .00078	< .00078
Trichloroethylene		< .0028	< .0028	< .0028	< .0028	< .0028
Trichlorofluoromethane		< .0059	< .0059	.0075	< .0059	< .0059
Xylenes		< .0015	< .0015	< .0015	.066	< .0015
OTHER						
Total Organic Carbon						
Total Petroleum Hydrocarbons		4250	< 27.8	64900	36100	262

NOTES:
FLC = USAEC Flagging Code
DQ = Data Qualifier
< = Concentration was less than the certified reporting limit

T = Non-target compound analyzed for and not detected (non-GC/MS method)
I = Interferences in the sample caused the quantitation and/or identification to be suspect
M = High duplicate spike not within control limits
C = Analysis was confirmed by a different column or technique
Z = Non-target analyte analyzed for and detected by non-GC/MS method
J = Value is estimated
= Exceeds established Devens background levels

TABLE 2-4
RI SOIL OFF-SITE ANALYTICAL RESULTS
AOC 57

FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MASSACHUSETTS

Site ID: Field Sample Number: Lab Sample Number: Sample Date: Depth: Units:	Devens Background Concentrations mg/kg	AREA 3 57E-96-30X EX573006 DV4S*518 08/20/96 6 mg/kg	57E-96-31X EX573106 DV4S*519 08/21/96 6 mg/kg	57M-95-03X BX570310 DV4S*155 10/03/95 10 mg/kg	57M-95-04A BX574A01 DV4S*161 10/04/95 1 mg/kg	57M-95-04X BX570402 DV4S*156 10/03/95 2 mg/kg
METALS						
Aluminum	18000	3240	3060	NA	NA	NA
Antimony	0.5	< 1.09	< 1.09	NA	NA	NA
Arsenic	19	6.74	17	NA	NA	NA
Barium	54	12	10.1	NA	NA	NA
Beryllium	0.81	< .5	< .5	NA	NA	NA
Cadmium	1.28	< .7	< .7	NA	NA	NA
Calcium	810	789	385	NA	NA	NA
Chromium	33	5.25	< 4.05	NA	NA	NA
Cobalt	4.7	< 1.42	< 1.42	NA	NA	NA
Copper	13.5	4.93	5.37	NA	NA	NA
Iron	18000	3980	5020	NA	NA	NA
Lead	48	5.07 J	25.5	NA	NA	NA
Magnesium	5500	898	745	NA	NA	NA
Manganese	380	53.2	51.3	NA	NA	NA
Nickel	14.6	6.05	3.94	NA	NA	NA
Potassium	2400	523	294	NA	NA	NA
Selenium	--	< .25	< .25	NA	NA	NA
Silver	0.086	< .589	< .589	NA	NA	NA
Sodium	131	456	403	NA	NA	NA
Vanadium	32.3	4.92	4.58	NA	NA	NA
Zinc	43.9	10.5	11.9	NA	NA	NA
PESTICIDES/PCBS						
4,4'-dde		< .00765	< .00765	NA	NA	NA
4,4'-ddt		< .00707	< .00707	NA	NA	NA
Aldrin		< .00729	< .00729	NA	NA	NA
Chlordane - Alpha		< .005 T	.068 C	NA	NA	NA
Dieldrin		< .00629	< .00629	NA	NA	NA
Endosulfan I		< .00602	< .00602	NA	NA	NA
Heptachlor Epoxide		< .0062	.00691 C	NA	NA	NA
Pcb 1242		< .082 T	< .082 T	NA	NA	NA
Pcb 1248		< .082 T	< .082 T	NA	NA	NA
Pcb 1260		< .0804	< .0804	NA	NA	NA
SVOCs						
1,2,4-trichlorobenzene		< .08	< .2	NA	NA	NA
1,2-dichlorobenzene		< .2	< .6	NA	NA	NA
1,4-dichlorobenzene		< .2	< .5	NA	NA	NA
2-methylnaphthalene		< .1	< .2	NA	NA	NA
Acenaphthene		< .07	< .2	NA	NA	NA
Chrysene		< .2	< .6	NA	NA	NA
Dibenzofuran		< .07	< .2	NA	NA	NA
Fluoranthene		< .1	< .3	NA	NA	NA
Fluorene		< .07	< .2	NA	NA	NA
Naphthalene		2	< .2	NA	NA	NA
Phenanthrene		< .07	< .2	NA	NA	NA
Pyrene		< .07	.5	NA	NA	NA

TABLE 2-4
RI SOIL OFF-SITE ANALYTICAL RESULTS
AOC 57

FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MASSACHUSETTS

Site ID: Field Sample Number: Lab Sample Number: Sample Date: Depth: Units:	Devens Background Concentrations mg/kg		57E-96-30X EX573006 DV4S*518 08/20/96 6 mg/kg		57E-96-31X EX573106 DV4S*519 08/21/96 6 mg/kg	57M-95-03X BX570310 DV4S*155 10/03/95 10 mg/kg	57M-95-04A BX574A01 DV4S*161 10/04/95 1 mg/kg	57M-95-04X BX570402 DV4S*156 10/03/95 2 mg/kg
Bis(2-ethylhexyl) Phthalate		<	1	<	3	NA	NA	NA
Di-n-butyl Phthalate		<	.1	<	.3	NA	NA	NA
TPH BY GC								
TPH MOTOR OIL PATTERN			5320		6800	NA	NA	NA
VOCs								
*1,2-dichloroethylenes (cis And Trans)		<	.003	<	.003	NA	NA	NA
2-hexanone			.071	<	.032	NA	NA	NA
Acetone		<	.017	<	.017	NA	NA	NA
Chloroform		<	.00087	<	.00087	NA	NA	NA
Dichloromethane		<	.012	<	.012	NA	NA	NA
Ethylbenzene		<	.0017	<	.0017	NA	NA	NA
Tetrachloroethene		<	.00081	<	.00081	NA	NA	NA
Toluene		<	.00078	<	.00078	NA	NA	NA
Trichloroethylene		<	.0028	<	.0028	NA	NA	NA
Trichlorofluoromethane		<	.0059	<	.0059	NA	NA	NA
Xylenes			.13	<	.0015	NA	NA	NA
OTHER								
Total Organic Carbon						566	5450	36400
Total Petroleum Hydrocarbons			6960		18300			

NOTES:
FLC = USAEC Flagging Code
DQ = Data Qualifier
< = Concentration was less than the certified reporting limit

T = Non-target compound analyzed for and not detected (non-GC/MS method)
I = Interferences in the sample caused the quantitation and/or identification to be suspect
M = High duplicate spike not within control limits
C = Analysis was confirmed by a different column or technique
Z = Non-target analyte analyzed for and detected by non-GC/MS method
J = Value is estimated
= Exceeds established Devens background levels

TABLE 2-4
RI SOIL OFF-SITE ANALYTICAL RESULTS
AOC 57

FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MASSACHUSETTS

		AREA 3				
Site ID: Field Sample Number: Lab Sample Number: Sample Date: Depth: Units:	Devens Background Concentrations mg/kg	57M-95-05X BX570514 DV4S*157 10/03/95 14 mg/kg	57M-95-06X BX570615 DV4S*158 10/04/95 15 mg/kg	57M-95-07X BX570704 DV4S*159 10/04/95 4 mg/kg	57M-95-08A BX578A07 DV4S*162 10/10/95 7 mg/kg	57M-95-08B BX578B04 DV4S*160 10/06/95 4 mg/kg
METALS						
Aluminum	18000	NA	NA	NA	NA	NA
Antimony	0.5	NA	NA	NA	NA	NA
Arsenic	19	NA	NA	NA	NA	NA
Barium	54	NA	NA	NA	NA	NA
Beryllium	0.81	NA	NA	NA	NA	NA
Cadmium	1.28	NA	NA	NA	NA	NA
Calcium	810	NA	NA	NA	NA	NA
Chromium	33	NA	NA	NA	NA	NA
Cobalt	4.7	NA	NA	NA	NA	NA
Copper	13.5	NA	NA	NA	NA	NA
Iron	18000	NA	NA	NA	NA	NA
Lead	48	NA	NA	NA	NA	NA
Magnesium	5500	NA	NA	NA	NA	NA
Manganese	380	NA	NA	NA	NA	NA
Nickel	14.6	NA	NA	NA	NA	NA
Potassium	2400	NA	NA	NA	NA	NA
Selenium	--	NA	NA	NA	NA	NA
Silver	0.086	NA	NA	NA	NA	NA
Sodium	131	NA	NA	NA	NA	NA
Vanadium	32.3	NA	NA	NA	NA	NA
Zinc	43.9	NA	NA	NA	NA	NA
PESTICIDES/PCBS						
4,4'-dde		NA	NA	NA	NA	NA
4,4'-ddt		NA	NA	NA	NA	NA
Aldrin		NA	NA	NA	NA	NA
Chlordane - Alpha		NA	NA	NA	NA	NA
Dieldrin		NA	NA	NA	NA	NA
Endosulfan I		NA	NA	NA	NA	NA
Heptachlor Epoxide		NA	NA	NA	NA	NA
Pcb 1242		NA	NA	NA	NA	NA
Pcb 1248		NA	NA	NA	NA	NA
Pcb 1260		NA	NA	NA	NA	NA
SVOCs						
1,2,4-trichlorobenzene		NA	NA	NA	NA	NA
1,2-dichlorobenzene		NA	NA	NA	NA	NA
1,4-dichlorobenzene		NA	NA	NA	NA	NA
2-methylnaphthalene		NA	NA	NA	NA	NA
Acenaphthene		NA	NA	NA	NA	NA
Chrysene		NA	NA	NA	NA	NA
Dibenzofuran		NA	NA	NA	NA	NA
Fluoranthene		NA	NA	NA	NA	NA
Fluorene		NA	NA	NA	NA	NA
Naphthalene		NA	NA	NA	NA	NA
Phenanthrene		NA	NA	NA	NA	NA
Pyrene		NA	NA	NA	NA	NA

TABLE 2-4
RI SOIL OFF-SITE ANALYTICAL RESULTS
AOC 57

FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MASSACHUSETTS

Site ID: Field Sample Number: Lab Sample Number: Sample Date: Depth: Units:	Devens Background Concentrations mg/kg	57M-95-05X BX570514 DV4S*157 10/03/95 14 mg/kg	57M-95-06X BX570615 DV4S*158 10/04/95 15 mg/kg	57M-95-07X BX570704 DV4S*159 10/04/95 4 mg/kg	57M-95-08A BX578A07 DV4S*162 10/10/95 7 mg/kg	57M-95-08B BX578B04 DV4S*160 10/06/95 4 mg/kg
Bis(2-ethylhexyl) Phthalate		NA	NA	NA	NA	NA
Di-n-butyl Phthalate		NA	NA	NA	NA	NA
TPH BY GC						
TPH MOTOR OIL PATTERN		NA	NA	NA	NA	NA
VOCs						
*1,2-dichloroethylenes (cis And Trans)		NA	NA	NA	NA	NA
2-hexanone		NA	NA	NA	NA	NA
Acetone		NA	NA	NA	NA	NA
Chloroform		NA	NA	NA	NA	NA
Dichloromethane		NA	NA	NA	NA	NA
Ethylbenzene		NA	NA	NA	NA	NA
Tetrachloroethene		NA	NA	NA	NA	NA
Toluene		NA	NA	NA	NA	NA
Trichloroethylene		NA	NA	NA	NA	NA
Trichlorofluoromethane		NA	NA	NA	NA	NA
Xylenes		NA	NA	NA	NA	NA
OTHER						
Total Organic Carbon		673	561	1380	523	752
Total Petroleum Hydrocarbons						

NOTES:
FLC = USAEC Flagging Code
DQ = Data Qualifier
< = Concentration was less than the certified reporting limit

T = Non-target compound analyzed for and not detected (non-GC/MS method)
I = Interferences in the sample caused the quantitation and/or identification to be suspect
M = High duplicate spike not within control limits
C = Analysis was confirmed by a different column or technique
Z = Non-target analyte analyzed for and detected by non-GC/MS method
J = Value is estimated
= Exceeds established Devens background levels

TABLE 2-4
RI SOIL OFF-SITE ANALYTICAL RESULTS
AOC 57

FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MASSACHUSETTS

		AREA 3				
Site ID: Field Sample Number: Lab Sample Number: Sample Date: Depth: Units:	Devens Background Concentrations mg/kg	57M-96-09X BX570914 DV4S*530 08/27/96 14 mg/kg	57M-96-10X BX571005 DV4S*531 08/30/96 5 mg/kg	57M-96-11X BX571105 DV4S*532 08/30/96 5 mg/kg	57M-96-12X BX571204 DV4S*563 08/29/96 4 mg/kg	57M-96-13X BX571305 DV4S*564 08/29/96 5 mg/kg
METALS						
Aluminum	18000	NA	NA	NA	NA	NA
Antimony	0.5	NA	NA	NA	NA	NA
Arsenic	19	NA	NA	NA	NA	NA
Barium	54	NA	NA	NA	NA	NA
Beryllium	0.81	NA	NA	NA	NA	NA
Cadmium	1.28	NA	NA	NA	NA	NA
Calcium	810	NA	NA	NA	NA	NA
Chromium	33	NA	NA	NA	NA	NA
Cobalt	4.7	NA	NA	NA	NA	NA
Copper	13.5	NA	NA	NA	NA	NA
Iron	18000	NA	NA	NA	NA	NA
Lead	48	NA	NA	NA	NA	NA
Magnesium	5500	NA	NA	NA	NA	NA
Manganese	380	NA	NA	NA	NA	NA
Nickel	14.6	NA	NA	NA	NA	NA
Potassium	2400	NA	NA	NA	NA	NA
Selenium	--	NA	NA	NA	NA	NA
Silver	0.086	NA	NA	NA	NA	NA
Sodium	131	NA	NA	NA	NA	NA
Vanadium	32.3	NA	NA	NA	NA	NA
Zinc	43.9	NA	NA	NA	NA	NA
PESTICIDES/PCBS						
4,4'-dde		NA	NA	NA	NA	NA
4,4'-ddt		NA	NA	NA	NA	NA
Aldrin		NA	NA	NA	NA	NA
Chlordane - Alpha		NA	NA	NA	NA	NA
Dieldrin		NA	NA	NA	NA	NA
Endosulfan I		NA	NA	NA	NA	NA
Heptachlor Epoxide		NA	NA	NA	NA	NA
Pcb 1242		NA	NA	NA	NA	NA
Pcb 1248		NA	NA	NA	NA	NA
Pcb 1260		NA	NA	NA	NA	NA
SVOCs						
1,2,4-trichlorobenzene		NA	NA	NA	NA	NA
1,2-dichlorobenzene		NA	NA	NA	NA	NA
1,4-dichlorobenzene		NA	NA	NA	NA	NA
2-methylnaphthalene		NA	NA	NA	NA	NA
Acenaphthene		NA	NA	NA	NA	NA
Chrysene		NA	NA	NA	NA	NA
Dibenzofuran		NA	NA	NA	NA	NA
Fluoranthene		NA	NA	NA	NA	NA
Fluorene		NA	NA	NA	NA	NA
Naphthalene		NA	NA	NA	NA	NA
Phenanthrene		NA	NA	NA	NA	NA
Pyrene		NA	NA	NA	NA	NA

TABLE 2-4
RI SOIL OFF-SITE ANALYTICAL RESULTS
AOC 57

FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MASSACHUSETTS

Site ID: Field Sample Number: Lab Sample Number: Sample Date: Depth: Units:	Devens Background Concentrations mg/kg	57M-96-09X BX570914 DV4S*530 08/27/96 14 mg/kg	57M-96-10X BX571005 DV4S*531 08/30/96 5 mg/kg	57M-96-11X BX571105 DV4S*532 08/30/96 5 mg/kg	57M-96-12X BX571204 DV4S*563 08/29/96 4 mg/kg	57M-96-13X BX571305 DV4S*564 08/29/96 5 mg/kg
Bis(2-ethylhexyl) Phthalate		NA	NA	NA	NA	NA
Di-n-butyl Phthalate		NA	NA	NA	NA	NA
TPH BY GC						
TPH MOTOR OIL PATTERN		NA	NA	NA	NA	NA
VOCs						
*1,2-dichloroethylenes (cis And Trans)		NA	NA	NA	NA	NA
2-hexanone		NA	NA	NA	NA	NA
Acetone		NA	NA	NA	NA	NA
Chloroform		NA	NA	NA	NA	NA
Dichloromethane		NA	NA	NA	NA	NA
Ethylbenzene		NA	NA	NA	NA	NA
Tetrachloroethene		NA	NA	NA	NA	NA
Toluene		NA	NA	NA	NA	NA
Trichloroethylene		NA	NA	NA	NA	NA
Trichlorofluoromethane		NA	NA	NA	NA	NA
Xylenes		NA	NA	NA	NA	NA
OTHER						
Total Organic Carbon		792	1180	722	834	719
Total Petroleum Hydrocarbons						

NOTES:
FLC = USAEC Flagging Code
DQ = Data Qualifier
< = Concentration was less than the certified reporting limit

T = Non-target compound analyzed for and not detected (non-GC/MS method)
I = Interferences in the sample caused the quantitation and/or identification to be suspect
M = High duplicate spike not within control limits
C = Analysis was confirmed by a different column or technique
Z = Non-target analyte analyzed for and detected by non-GC/MS method
J = Value is estimated
= Exceeds established Devens background levels

TABLE 2-5
1998 SOIL FIELD AND OFF-SITE ANALYTICAL RESULTS
AOC 57

FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MASSACHUSETTS

Parm.	Method	Analyte	Units	Area 2 57S-98-01X SX570101 5/19/98	57S-98-02X SX570200 5/19/98	57S-98-03X SX570302 5/19/98	57S-98-04X SX570401 5/19/98	57S-98-05X SX570503 5/19/98	57S-98-06X SX570601 5/19/98	57S-98-07X SD570700 5/19/98
Volatile Organics										
	LM19	1,1,1-trichloroethane	mg/kg	LT .0044	LT .0044	LT .0044	LT .0044	LT .0044	LT .0044	LT .0044 d
	LM19	*1,2-dichloroethylenes (cis And Trans)	mg/kg	LT .003	LT .003	LT .003	LT .003	LT .003	.01	LT .003 d
	LM19	Acetone	mg/kg	LT .017	LT .017	LT .017	LT .017	LT .017	LT .017	LT .017 d
	LM19	Chlorobenzene	mg/kg	LT .00086	LT .00086	LT .00086	LT .00086	LT .00086	LT .00086	LT .00086 d
	LM19	Ethylbenzene	mg/kg	LT .0017	LT .0017	LT .0017	LT .0017	LT .0017	.0033	LT .0017 d
	LM19	Toluene	mg/kg	LT .00078	LT .00078	LT .00078	LT .00078	LT .00078	LT .00078	LT .00078 d
	LM19	Trichloroethylene	mg/kg	LT .0028	LT .0028	LT .0028	LT .0028	LT .0028	LT .0028	LT .0028 d
	LM19	Xylenes	mg/kg	LT .0015	LT .0015	LT .0015	LT .0015	LT .0015	LT .0015	LT .0015 d
Semivolatile Organics										
	LM18	1,2-dichlorobenzene	mg/kg	LT .11	LT .6	LT 2	LT .6	LT .6	LT .6	LT .11 d
	LM18	1,4-dichlorobenzene	mg/kg	LT .098	LT .5	LT 2	LT .5	LT .5	LT .5	LT .098 d
	LM18	2-methylnaphthalene	mg/kg	LT .049	.6	LT 1	LT .2	LT .2	LT .2	LT .049 d
	LM18	Acenaphthylene	mg/kg	LT .033	.4	LT .7	LT .2	LT .2	LT .2	LT .033 d
	LM18	bis(2-ethylhexyl) Phthalate	mg/kg	LT .62	LT 3	LT 10	LT 3	LT 3	LT 3	LT .62 d
	LM18	Benzo[k]fluoranthene	mg/kg	LT .066	1	LT 1	LT .3	LT .3	LT .3	LT .066 d
	LM18	Chrysene	mg/kg	LT .12	1	LT 2	LT .6	LT .6	LT .6	LT .12 d
	LM18	Fluoranthene	mg/kg	LT .068	2	LT 1	LT .3	LT .3	LT .3	LT .068 d
	LM18	Naphthalene	mg/kg	LT .037	.4	LT .7	LT .2	LT .2	LT .2	LT .037 d
	LM18	Phenanthrene	mg/kg	LT .033	1	LT .7	LT .2	LT .2	.3	LT .033 d
	LM18	Pyrene	mg/kg	LT .033	2	LT .7	LT .2	LT .2	.4	LT .033 d
Pesticides/PCBs										
	LH10	Chlordane - Alpha	mg/kg	ND .00133 t	ND .00133 t	ND .00133 t	ND .00133 t	ND .00133 t	ND .00133 t	ND .00133 td
	LH10	Dieldrin	mg/kg	LT .00629	LT .00629	.043 c	LT .00629	LT .00629	LT .00629	LT .00629 d
	LH10	Chlordane - Gamma	mg/kg	ND .00133 t	ND .00133 t	ND .00133 t	ND .00133 t	ND .00133 t	ND .00133 t	ND .00133 td
	LH10	4,4'-DDD	mg/kg	LT .00826	LT .00826	.044 c	LT .00826	.027 c	LT .00826	LT .00826 d
	LH10	4,4'-DDE	mg/kg	LT .00765	.0194 c	LT .00765	LT .00765	LT .00765	LT .00765	LT .00765 d
	LH10	4,4'-DDT	mg/kg	LT .00707	.12 c	.0352 c	LT .00707	LT .00707	LT .00707	.0625 cd
	LH16	Pcb 1260	mg/kg	LT .0804	.548 c	5.2 c	.186 c	.224 c	LT .0804	.581 dc
Other										
	9071	Total Petroleum Hydrocarbons	mg/kg	393	1200	14800	1150	1750	4620	1830 d
Metals-ICP										
	JS16	Barium	mg/kg	17.2	113	51.1	15.5	22.7	10.7	60.3 d
	JS16	Copper	mg/kg	3.01	41.3	14.7	7	6.13	2.45	28.3 d
	JS16	Manganese	mg/kg	36.7	679	86.8	69.2	74.6	128	66.3 d
	JS16	Lead	mg/kg	18.7	271	167	39.7	42.9	24.9	297 d
	JS16	Zinc	mg/kg	14.9	150	46.6	20.1	29.3	LT 8.03	77.4 d
Metals-ICP-MS										
	J301	Arsenic	mg/kg	15.3	45	20	7.02	25	20.6	38.8 d
	J301	Selenium	mg/kg	1.3	3	2.14	0.39	0.704	0.951	2.66
VPH Ranges (mg/kg)										
		n-C5 to n-C8 Aliphatic	mg/kg	<1.3	< 2.5 j	< 1.6 j	< 1.3	< 1.0	<2.3 j	< 8.7 j
		n-C9 to n-C12 Aliphatic	mg/kg	4.3	2.5 j	1.9 j	< 1.3	2.1	3.9 j	15 j
		n-C9 to n-C10 Aromatic	mg/kg	<1.3	< 2.5 j	< 1.6 j	< 1.3	< 1.0	<2.3 j	21 j
EPH Ranges (mg/kg)										
		n-C9 to n-C18 Aliphatic	mg/kg	<44 j	<55 j	110 j	<37 j	<33 j	120 j	<170 j
		n-C19 to n-C36 Aliphatic	mg/kg	68	360	3300	260	610	830	1800
		n-C11 to n-C22 Aromatic	mg/kg	<44	240	990	140	140	190	590
On-Site TPH (mg/kg-dry)			mg/kg	1000	1400	14000	680	3200	2500	<740

Notes:
C = analysis confirmed
d = duplicate
j = estimate
LT = less than
t = non-target compound
[shaded box] = exceeds established Devens background concentration

TABLE 2-5
1998 SOIL FIELD AND OFF-SITE ANALYTICAL RESULTS
AOC 57

FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MASSACHUSETTS

				Area 2				Area 3		
Parm	Method	Analyte	Units	57S-98-07X SX570700 5/19/98	57S-98-07X SX570701 5/19/98	57S-98-08X SX570800 5/19/98	57S-98-09X SX570900 5/19/98	57S-98-13X SX571301 5/20/98	57S-98-14X SX571401 5/20/98	57S-98-15X SX571503 5/20/98
Volatile Organics										
	LM19	1,1,1-trichloroethane	mg/kg	LT .0044	LT .0044	LT .0044	LT .0044	LT .0044	LT .0044	.013
	LM19	*1,2-dichloroethylenes (cis And Trans)	mg/kg	LT .003	.016	LT .003	LT .003	LT .003	LT .003	LT .003
	LM19	Acetone	mg/kg	.33	.073	LT .017	LT .017	LT .017	LT .017	LT .017
	LM19	Chlorobenzene	mg/kg	LT .00086	LT .00086	LT .00086	LT .00086	.012	LT .00086	LT .00086
	LM19	Ethylbenzene	mg/kg	LT .0017	.022	LT .0017	LT .0017	LT .0017	LT .0017	LT .0017
	LM19	Toluene	mg/kg	LT .00078	LT .00078	LT .00078	LT .00078	LT .00078	LT .00078	.0013
	LM19	Trichloroethylene	mg/kg	LT .0028	LT .0028	LT .0028	LT .0028	.0042	LT .0028	LT .0028
	LM19	Xylenes	mg/kg	LT .0015	LT .0015	LT .0015	LT .0015	LT .0015	LT .0015	.0041
Semivolatile Organics										
	LM18	1,2-dichlorobenzene	mg/kg	LT .6	LT 1	LT .6	LT .6	.35	LT .11	LT .11
	LM18	1,4-dichlorobenzene	mg/kg	LT .5	LT 1	LT .5	LT .5	.48	LT .098	LT .098
	LM18	2-methylnaphthalene	mg/kg	LT .2	LT .5	LT .2	LT .2	LT .049	LT .049	LT .049
	LM18	Acenaphthylene	mg/kg	LT .2	LT .3	LT .2	LT .2	LT .033	LT .033	LT .033
	LM18	bis(2-ethylhexyl) Phthalate	mg/kg	LT 3	LT 6	LT 3	LT 3	LT .62	LT .62	14
	LM18	Benzo[k]fluoranthene	mg/kg	LT .3	LT .7	LT .3	LT .3	LT .066	LT .066	LT .066
	LM18	Chrysene	mg/kg	LT .6	LT 1	LT .6	LT .6	LT .12	LT .12	LT .12
	LM18	Fluoranthene	mg/kg	LT .3	LT .7	2	LT .3	.13	LT .068	LT .068
	LM18	Naphthalene	mg/kg	LT .2	LT .4	LT .2	LT .2	LT .037	LT .037	LT .037
	LM18	Phenanthrene	mg/kg	LT .2	LT .3	1	.8	.067	LT .033	LT .033
	LM18	Pyrene	mg/kg	LT .2	LT .3	2	.9	.096	LT .033	LT .033
Pestibides/PCBs										
	LH10	Chlordane - Alpha	mg/kg	ND .00133 t	ND .00133 t	ND .00132 t	ND .00133 t	.00282 cz	ND .00133 t	ND .00133 t
	LH10	Dieldrin	mg/kg	LT .00629	LT .00629	LT .00629	.0228 c	LT .00629	LT .00629	LT .00629
	LH10	Chlordane - Gamma	mg/kg	ND .00133 t	ND .00133 t	ND .00132 t	ND .00133 t	.00278 cz	ND .00133 t	ND .00133 t
	LH10	4,4'-DDD	mg/kg	LT .00826	LT .00826	LT .00826	.0372 c	.0234 c	LT .00826	LT .00826
	LH10	4,4'-DDE	mg/kg	LT .00765	LT .00765	.0361 c	.0524 c	LT .00765	LT .00765	LT .00765
	LH10	4,4'-DDT	mg/kg	.0713 c	LT .00707	.0351 c	.18 c	LT .00707	.0248 c	LT .00707
	LH16	Pcb 1260	mg/kg	.466 c	.513 c	LT .0804	.255 c	LT .0804	.474 c	LT .0804
Other										
	9071	Total Petroleum Hydrocarbons	mg/kg	6170	17000	494	1930	951	895	LT 27.9
Metals-ICP										
	JS16	Barium	mg/kg	66.8	50.9	110	69.1	17.1	14.6	13.1
	JS16	Copper	mg/kg	30.3	8.78	16	30.7	2.93	3.46	2.2
	JS16	Manganese	mg/kg	81.8	131	46	161	170	69.5	70.8
	JS16	Lead	mg/kg	320	63.9	173	299	22	LT 10.5	LT 10.5
	JS16	Zinc	mg/kg	84.6	96.6	78.5	73.6	15.8	27.5	13.3
Metals-ICP-MS										
	J301	Arsenic	mg/kg	61.2	44.8	13.4	43.2	25.6	28	28.2
	J301	Selenium	mg/kg	4.42	3.51	2.75	4.25	1.56	IT 0.250	0.485
VPH Ranges (mg/kg)										
		n-C5 to n-C8 Aliphatic	mg/kg	<9.3 j	< 3.5 j	<5.3 j	<3.6 j	<1.8 j	<1.4	<1.3
		n-C9 to n-C12 Aliphatic	mg/kg	<9.3 j	15 j	6.4 j	6.4 j	3.7 j	<1.4	<1.3
		n-C9 to n-C10 Aromatic	mg/kg	12 j	< 3.5 j	13 j	<3.6 j	<1.8 j	<1.4	<1.3
EPH Ranges (mg/kg)										
		n-C9 to n-C18 Aliphatic	mg/kg	<160 j	270 j	<100 j	<83 j	<46 j	<40 j	<37 j
		n-C19 to n-C36 Aliphatic	mg/kg	2100	1600	<100	240	180	150	<37
		n-C11 to n-C22 Aromatic	mg/kg	510	450	<100	110	60	75 j	<37
On-Site TPH mg/kg-dry)			mg/kg	<800	32000	<800	1500	1600	1200	<279

Notes:
C = analysis confirmed
d = duplicate
j = estimate
LT = less than
t = non-target compound
[shaded box] = exceeds established Devens background concentration

TABLE 2-6
RI GROUNDWATER FIELD ANALYTICAL RESULTS
AOC 57

FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MASSACHUSETTS

		AREA 2				AREA 3				
	Lab Sample ID:	57M-95-01X	57M-95-02X	57M-95-06X	57M-95-07X	57R-95-02X	57R-95-03X	57R-95-04X	57R-95-05X	57R-95-06X
	Date analyzed:	12-Oct-95	3-Oct-95	4-Oct-95	5-Oct-95	3-Oct-95	3-Oct-95	3-Oct-95	3-Oct-95	2-Oct-95
	Depth (bgs):	17	17	15	3	12	12	12	11	11
	Dilution:	1	1	1	1	1	1	1	5	1
Analytes	Reporting Limit									
Vinyl Chloride	2 µg/l	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1-DCE	5 µg/l	5.0 UJ	5.0 U	5.0 UJ	5.0 U	5.0 U	5.0 U	5.0 U	25 U	5.0 U
t-1,2-DCE	2 µg/l	NA	NA	NA	NA	NA	NA	NA	NA	NA
c-1,2-DCE	2 µg/l	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloroform	2 µg/l	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	10 U	2.0 U
1,1,1-TCA	2 µg/l	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	10 U	2.0 U
Carbon Tetrachloride	2 µg/l	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	10 U	2.0 U
Trichloroethene	2 µg/l	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	10 U	2.0 U
Tetrachloroethene	2 µg/l	2.0 U	2.0 U	2.0 U	2.5	2.1	2.0 U	2.5	10 U	2.0 U
1,3-DCB	2 µg/l	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,4-DCB	2 µg/l	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2-DCB	2 µg/l	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene	2 µg/l	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	3.5	2.0 U	110	2.0 U
Toluene	2 µg/l	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.6	240	2.0 UJ
Chlorobenzene	2 µg/l	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	15	2.0 U
Ethylbenzene	2 µg/l	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	3.1	410	2.0 U
m/p-Xylene	4 µg/l	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	6.7	7	1100	4.0 U
o-Xylene	2 µg/l	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	23	2.6	550	7.4
Naphthalene	2 µg/l	NA	NA	NA	NA	NA	NA	NA	NA	NA
TPH-dro	100 mg/l	NA	NA	NA	NA	NA	NA	NA	NA	NA
TPH-gro	100 µg/l	100 U	100 U	100 U	100 U	100 U	100 U	100 U	43000 E	100 U

Notes:

U = Concentration is less than reporting limit
J = Value is estimated
E = Concentration exceeds the maximum reporting limit
NA = Not analyzed

TABLE 2-6
RI GROUNDWATER FIELD ANALYTICAL RESULTS
AOC 57

FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MASSACHUSETTS

		AREA 3								
	Lab Sample ID:	57R-96-08X	57R-96-09X	57R-96-09X	57R-96-10X	57R-96-11X	57R-96-11X	57R-96-12X	57R-96-12X	57R-96-13X
	Date analyzed:	20-Aug-96	21-Aug-96	27-Aug-96	21-Aug-96	21-Aug-96	28-Aug-96	21-Aug-96	28-Aug-96	21-Aug-96
	Depth (bgs):	11	13	13A	13	15	15A	14	14A	11
	Dilution:	1	1	1	1	1	1	1	1	1
Analytes	Reporting Limit									
Vinyl Chloride	2 µg/l	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,1-DCE	5 µg/l	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
t-1,2-DCE	2 µg/l	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
c-1,2-DCE	2 µg/l	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Chloroform	2 µg/l	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,1,1-TCA	2 µg/l	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Carbon Tetrachloride	2 µg/l	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Trichloroethene	2 µg/l	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Tetrachloroethene	2 µg/l	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.7	2.0 U
1,3-DCB	2 µg/l	NA	NA	2.0 U	NA	NA	2.0 U	NA	2.0 U	NA
1,4-DCB	2 µg/l	NA	NA	2.0 U	NA	NA	2.0 U	NA	2.0 U	NA
1,2-DCB	2 µg/l	NA	NA	2.0 U	NA	NA	2.0 U	NA	2.0 U	NA
Benzene	2 µg/l	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Toluene	2 µg/l	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.8
Chlorobenzene	2 µg/l	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Ethylbenzene	2 µg/l	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
m/p-Xylene	4 µg/l	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U
o-Xylene	2 µg/l	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Naphthalene	2 µg/l	NA	NA	2.0 U	NA	NA	2.0 U	NA	2.0 U	NA
TPH-dro	100 mg/l	NA	NA	NA	NA	NA	NA	NA	NA	NA
TPH-gro	100 µg/l	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

U = Concentration is less than reporting limit
J = Value is estimated
E = Concentration exceeds the maximum reportin
NA = Not analyzed

TABLE 2-6
RI GROUNDWATER FIELD ANALYTICAL RESULTS
AOC 57

FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MASSACHUSETTS

		AREA 3								
	Lab Sample ID:	57R-96-14X	57R-96-14X	57R-96-15X	57R-96-15X	57R-96-16X	57R-96-16X	57R-96-17X	57R-96-18X	57R-96-19X
	Date analyzed:	21-Aug-96	28-Aug-96	23-Aug-96	26-Aug-96	23-Aug-96	28-Aug-96	26-Aug-96	26-Aug-96	28-Aug-96
	Depth (bgs):	10	11A	10	10A	10	11	11	11	11
	Dilution:	1	1	100	1	1	1	1	1	50
Analytes	**Reporting Limit**									
Vinyl Chloride	2 µg/l	2.0 U	2.0 U	200 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	100 U
1,1-DCE	5 µg/l	2.0 U	2.0 U	200 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	100 U
t-1,2-DCE	2 µg/l	2.0 U	2.0 U	200 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	100 U
c-1,2-DCE	2 µg/l	2.0 U	2.0 U	200 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	100 U
Chloroform	2 µg/l	2.0 U	2.0 U	200 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	100 U
1,1,1-TCA	2 µg/l	2.0 U	2.0 U	200 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	100 U
Carbon Tetrachloride	2 µg/l	2.0 U	2.0 U	200 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	100 U
Trichloroethene	2 µg/l	2.0 U	2.0 U	200 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	100 U
Tetrachloroethene	2 µg/l	2.0 U	2.0 U	200 U	2.0 U	2.0 U	2.7	2.0 U	2.0 U	100 U
1,3-DCB	2 µg/l	NA	2.0 U	NA	2.0 U	NA	2.0 U	2.0 U	2.0 U	100 U
1,4-DCB	2 µg/l	NA	2.0 U	NA	2.0 U	NA	2.0 U	2.0 U	2.0 U	100 U
1,2-DCB	2 µg/l	NA	2.0 U	NA	2.6	NA	3.9	2.0 U	2.0 U	110
Benzene	2 µg/l	2.0 U	2.0 U	200 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	100 U
Toluene	2 µg/l	2.0 U	2.0 U	200 U	2.0 U	2.0 U	10	2.0 U	2.0 U	170
Chlorobenzene	2 µg/l	2.0 U	2.0 U	200 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	100 U
Ethylbenzene	2 µg/l	2.0 U	2.0 U	200 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	190
m/p-Xylene	4 µg/l	4.0 U	4.0 U	450	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	720
o-Xylene	2 µg/l	2.0 U	2.0 U	490	2.4	2	2.0 U	2.0 U	2.0 U	450
Naphthalene	2 µg/l	NA	2.0 U	NA	16	NA	3.6	2.0 U	2.4	130
TPH-dro	100 mg/l	NA	NA	NA	NA	NA	NA	NA	NA	NA
TPH-gro	100 µg/l	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

U = Concentration is less than reporting limit
J = Value is estimated
E = Concentration exceeds the maximum reportin
NA = Not analyzed

TABLE 2-6
RI GROUNDWATER FIELD ANALYTICAL RESULTS
AOC 57

FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MASSACHUSETTS

		AREA 3								
	Lab Sample ID:	57R-96-20X	57M-95-03X	57B-96-08X	57B-96-09X	57M-96-09X	57M-96-10X	57M-96-11X	57M-96-12X	57M-96-13X
	Date analyzed:	28-Aug-96	4-Oct-95	29-Aug-96	29-Aug-96	27-Aug-96	3-Sep-96	3-Sep-96	3-Sep-96	3-Sep-96
	Depth (bgs):	14		10	10	17	10	10	10	5
	Dilution:	1	1	1	1	1	1	1	1	1
Analytes	**Reporting Limit**									
Vinyl Chloride	2 µg/l	2.0 U	NA	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,1-DCE	5 µg/l	2.0 U	5.0 UJ	2.0 U	95	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
t-1,2-DCE	2 µg/l	2.0 U	NA	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
c-1,2-DCE	2 µg/l	2.0 U	NA	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Chloroform	2 µg/l	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,1,1-TCA	2 µg/l	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Carbon Tetrachloride	2 µg/l	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Trichloroethene	2 µg/l	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Tetrachloroethene	2 µg/l	2.0 U	2.0 U	3.2	2.0 U	2.0 U	2.0 U	2.7	2.0 U	2.0 U
1,3-DCB	2 µg/l	2.0 U	NA	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,4-DCB	2 µg/l	2.0 U	NA	3.1	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,2-DCB	2 µg/l	2.0 U	NA	5.8	2.0 U	2.0 U	2.0 U	2.5	2.0 U	2.0 U
Benzene	2 µg/l	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Toluene	2 µg/l	2.0 U	14	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.9
Chlorobenzene	2 µg/l	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Ethylbenzene	2 µg/l	2.0 U	9.1	6.4	2.0 U	2.0 U	2.0 U	2.6	2.0 U	2.8
m/p-Xylene	4 µg/l	4.0 U	31	17	4.0 U	4.0 U	4.0 U	4	4.0 U	4.0 U
o-Xylene	2 µg/l	2.0 U	17	9.2	2.0 U	2.0 U	2.0 U	4.7	2.0 U	2.0 U
Naphthalene	2 µg/l	2.0 U	NA	7.1 J	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
TPH-dro	100 mg/l	NA	NA	NA	NA	NA	NA	NA	NA	NA
TPH-gro	100 µg/l	NA	100 U	NA	NA	NA	NA	NA	NA	NA

Notes:

U = Concentration is less than reporting limit
J = Value is estimated
E = Concentration exceeds the maximum reportin
NA = Not analyzed

TABLE 2-6
RI GROUNDWATER FIELD ANALYTICAL RESULTS
AOC 57

FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MASSACHUSETTS

		AREA 3							
	Lab Sample ID:	57M-96-13X	57M-96-08A	57M-96-08B	57B-95-02X	57B-95-03X	57B-95-04X	57B-95-05X	57B-95-06X
	Date analyzed:	3-Sep-96	11-Oct-95	9-Oct-95	3-Oct-95	3-Oct-95	3-Oct-95	3-Oct-95	3-Oct-95
	Depth (bgs):	5D	4	4	17	21	13	15	14
	Dilution:	1	1	1	1	1	1	1	1
Analytes	**Reporting Limit**								
Vinyl Chloride	2 µg/l	2.0 U	NA	NA	NA	NA	NA	NA	NA
1,1-DCE	5 µg/l	2.0 U	5.0 UJ	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
t-1,2-DCE	2 µg/l	2.0 U	NA	NA	NA	NA	NA	NA	NA
c-1,2-DCE	2 µg/l	2.0 U	NA	NA	NA	NA	NA	NA	NA
Chloroform	2 µg/l	2.0 U	2.0 UJ	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,1,1-TCA	2 µg/l	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Carbon Tetrachloride	2 µg/l	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Trichloroethene	2 µg/l	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Tetrachloroethene	2 µg/l	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,3-DCB	2 µg/l	2.0 U	NA	NA	NA	NA	NA	NA	NA
1,4-DCB	2 µg/l	2.0 U	NA	NA	NA	NA	NA	NA	NA
1,2-DCB	2 µg/l	2.0 U	NA	NA	NA	NA	NA	NA	NA
Benzene	2 µg/l	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Toluene	2 µg/l	2.6	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Chlorobenzene	2 µg/l	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Ethylbenzene	2 µg/l	2.6	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
m/p-Xylene	4 µg/l	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U
o-Xylene	2 µg/l	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Naphthalene	2 µg/l	2.0 U	NA	NA	NA	NA	NA	NA	NA
TPH-dro	100 mg/l	NA	NA	NA	NA	NA	NA	NA	NA
TPH-gro	100 µg/l	NA	100 U	100 U	100 U	100 U	100 U	100 U	100 U

Notes:

U = Concentration is less than reporting limit
J = Value is estimated
E = Concentration exceeds the maximum reportin;
NA = Not analyzed

TABLE 2-7
RI GROUNDWATER OFF-SITE ANALYTICAL RESULTS
AOC 57

FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MASSACHUSETTS

Site ID Sample Date: / Field Sample Number: / Lab Sample Number: / Sample Date: / Depth: / Units:	Devens Background Concentrations µg/L	57M-95-01X MD5701X2 DV4F*455 2/13/96 24 µg/L		57M-95-01X MD5701X2 DV4W*455 02/13/96 24 µg/L		57M-95-01X MX5701X1 DV4F*167 10/30/95 24 µg/L		57M-95-01X MX5701X1 DV4W*167 10/30/95 24 µg/L		57M-95-01X MX5701X2 DV4F*168 02/13/96 24 µg/L		57M-95-01X MX5701X2 DV4W*168 02/13/96 24 µg/L
METALS												
Aluminum	6870	< 141	DF	< 141	D	< 141	F	4180		< 141	F	< 141
Arsenic	10.5	< 2.54	DF	< 2.54	D	< 2.54	F	24.5		< 2.54	F	< 2.54
Barium	39.6	51.9	DF	12.8	D	14.8	F	33.9		12.2	F	12.6
Cadmium	4.01	< 4.01	DF	< 4.01	D	< 4.01	F	< 4.01		< 4.01	F	< 4.01
Calcium	14700	5850	DF	5960	D	5620	F	6650		5860	F	6050
Copper	8.09	< 8.09	DF	< 8.09	D	< 8.09	F	10.1		< 8.09	F	< 8.09
Iron	9100	< 38.8	DF	< 38.8	D	72.9	F	5660		< 38.8	F	< 38.8
Lead	4.25	< 1.26	DF	< 1.26	D	1.41	F	8.46		< 1.26	F	< 1.26
Magnesium	3480	639	DF	627	D	612	F	1200		651	F	650
Manganese	291	31.2	DF	30.4	D	38.5	F	512		30.5	F	32.1
Potassium	2370	1730	DF	1410	D	1090	F	2700		1540	F	1120
Sodium	10800	16500	DF	16600	D	14500	F	17300		15700	F	16200
Zinc	21.1	< 21.1	DF	< 21.1	D	< 21.1	F	< 21.1		< 21.1	F	< 21.1
PESTICIDES/PCBS												
Endosulfan Ii				< .023	D			< .023				< .023
SEMIVOLATILE ORGANICS												
1,2-dichlorobenzene				< 1.7	D			< 1.7	N			< 1.7
1,4-dichlorobenzene				< 1.7	D			< 1.7	N			< 1.7
2-methylnaphthalene				< 1.7	D			< 1.7	N			< 1.7
4-methylphenol				< .52	D			< .52	N			< .52
Diethyl Phthalate				< 2	D			< 2	N			< 2
Naphthalene				< .5	D			< .5	N			< .5
Bis(2-ethylhexyl) Phthalate				< 4.8	D			< 4.8	N			< 4.8
VOLATILE ORGANICS												
*1,2-dichloroethylenes (cis And Trans)				< .5	D			< .5				< .5
1,1,1-trichloroethane				< .5	D			.5				< .5
Acetone				< 13	D			< 13				< 13
Carbon Tetrachloride				< .58	D			< .58				< .58
Chloroform				< .5	D			< .5				< .5
Dichloromethane				< 2.3	D			< 2.3				< 2.3
Ethylbenzene				< .5	D			< .5				< .5
Styrene				< .5	D			< .5				< .5
Tetrachloroethene				< 1.6	D			< 1.6				< 1.6
Toluene				< .5	D			.63				1.2
Trichloroethylene				< .5	D			.56				< .5
Xylenes				< .84	D			< .84				< .84
WET CHEMISTRY												
Alkalinity				6000	D			8000				5000
Chloride				27400	D			28500				25200
Nitrite, Nitrate-non Specific				1100	D			800				1200
Nitrogen By Kjeldahl Method				200	D			210				248
Phosphate				< 13.3	D			280				13.6
Sulfate				11000	D			< 10000				10000
Total Dissolved Solids				91000	D			76000				70000
Total Hardness				18400	D			14000				20000
Total Suspended Solids				< 4000	D			232000				5000
OTHER												
Total Petroleum Hydrocarbons				< 181	D			356				< 183

TABLE 2-7
RI GROUNDWATER OFF-SITE ANALYTICAL RESULTS
AOC 57

FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MASSACHUSETTS

Site ID: Sample Date: / Field Sample Number: / Lab Sample Number: / Sample Date: / Depth: / Units:	Devens Background Concentrations µg/L	57M-95-02X / MX5702X1 / DV4F*169 / 10/30/95 / 19 / µg/L	57M-95-02X / MX5702X1 / DV4W*169 / 10/30/95 / 19 / µg/L	57M-95-02X / MX5702X2 / DV4F*170 / 02/13/96 / 19 / µg/L	57M-95-02X / MX5702X2 / DV4W*170 / 02/13/96 / 19 / µg/L	57M-95-04A / MX5704A1 / DV4F*173 / 11/01/95 / 7.4 / µg/L
METALS						
Aluminum	6870	< 141 F	< 141	< 141 F	< 141	< 141 F
Arsenic	10.5	< 2.54 F	< 2.54	< 2.54 F	< 2.54	2.77 F
Barium	39.6	24.8 F	21	10.4 F	10.3	45.6 F
Cadmium	4.01	< 4.01 F	< 4.01	< 4.01 F	< 4.01	< 4.01 F
Calcium	14700	19300 F	13600	13100 F	12900	7770 F
Copper	8.09	< 8.09 F	9.81	< 8.09 F	< 8.09	< 8.09 F
Iron	9100	< 38.8 F	132	< 38.8 F	< 38.8	1380 F
Lead	4.25	< 1.26 F	3.25	< 1.26 F	< 1.26	< 1.26 F
Magnesium	3480	1520 F	1050	765 F	747	774 F
Manganese	291	< 2.75 F	7.52	< 2.75 F	< 2.75	1410 F
Potassium	2370	2180 F	1800	1560 F	1110	1240 F
Sodium	10800	44300 F	35300	13700 F	13200	6400 F
Zinc	21.1	< 21.1 F	< 21.1	< 21.1 F	< 21.1	< 21.1 F
PESTICIDES/PCBS						
Endosulfan Ii			< .023		< .023	
SEMIVOLATILE ORGANICS						
1,2-dichlorobenzene			< 1.7 N		< 1.7	
1,4-dichlorobenzene			< 1.7 N		< 1.7	
2-methylnaphthalene			< 1.7 N		< 1.7	
4-methylphenol			< .52 N		< .52	
Diethyl Phthalate			2.3 N		3.2	
Naphthalene			< .5 N		< .5	
Bis(2-ethylhexyl) Phthalate			< 4.8 N		< 4.8	
VOLATILE ORGANICS						
*1,2-dichloroethylenes (cis And Trans)			< .5		< .5	
1,1,1-trichloroethane			< .5		< .5	
Acetone			< 13		< 13	
Carbon Tetrachloride			< .58		< .58	
Chloroform			< .5		< .5	
Dichloromethane			< 2.3		< 2.3	
Ethylbenzene			< .5		< .5	
Styrene			< .5		< .5	
Tetrachloroethene			< 1.6		< 1.6	
Toluene			< .5		1.6	
Trichloroethylene			< .5		< .5	
Xylenes			< .84		< .84	
WET CHEMISTRY						
Alkalinity			20000		140000	
Chloride			55000		17600	
Nitrite, Nitrate-non Specific			2300		660	
Nitrogen By Kjeldahl Method			< 183		238	
Phosphate			< 13.3		15.8	
Sulfate			15000		14000	
Total Dissolved Solids			153000		96000	
Total Hardness			42000		37200	
Total Suspended Solids			4000		< 4000	
OTHER						
Total Petroleum Hydrocarbons			< 169		< 187	

TABLE 2-7
RI GROUNDWATER OFF-SITE ANALYTICAL RESULTS
AOC 57

FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MASSACHUSETTS

Site ID: Sample Date: / Field Sample Number: / Lab Sample Number: / Sample Date: / Depth: / Units:	Devens Background Concentrations µg/L	57M-95-04A MX5704A1 DV4W*173 11/01/95 7.4 µg/L	57M-95-04A MX5704A2 DV4F*174 02/14/96 7.4 µg/L	57M-95-04A MX5704A2 DV4W*174 02/14/96 7.4 µg/L	57M-95-04B MX5704B1 DV4F*185 11/01/95 23.5 µg/L	57M-95-04B MX5704B1 DV4W*185 11/01/95 23.5 µg/L	57M-95-04B MX5704B2 DV4F*459 02/14/96 23.5 µg/L
METALS							
Aluminum	6870	395	< 141 F	< 141	< 141 F	< 141	< 141 F
Arsenic	10.5	13.4	3.94 F	4.9	< 2.54 F	< 2.54	< 2.54 F
Barium	39.6	63.5	27.7 F	27.6	10.7 F	9.81	10.6 F
Cadmium	4.01	< 4.01	< 4.01 F	< 4.01	< 4.01 F	< 4.01	< 4.01 F
Calcium	14700	8880	7680 F	7720	9660 F	9770	12600 F
Copper	8.09	10.3	< 8.09 F	< 8.09	< 8.09 F	< 8.09	< 8.09 F
Iron	9100	6310	3530 F	3610	< 38.8 F	87.4	< 38.8 F
Lead	4.25	2.17	< 1.26 F	< 1.26	< 1.26 F	1.84	< 1.26 F
Magnesium	3480	828	904 F	866	981 F	999	1370 F
Manganese	291	3700	533 F	552	356 F	382	516 F
Potassium	2370	4140	1360 F	1030	2640 F	2790	2990 F
Sodium	10800	11800	5820 F	5850	30700 F	28900	34500 F
Zinc	21.1	25.3	< 21.1 F	< 21.1	< 21.1 F	< 21.1	< 21.1 F
PESTICIDES/PCBS							
Endosulfan Ii		< .023		< .023		< .023	
SEMIVOLATILE ORGANICS							
1,2-dichlorobenzene		< 1.7		< 1.7		< 1.7	
1,4-dichlorobenzene		< 1.7		< 1.7		< 1.7	
2-methylnaphthalene		< 1.7		< 1.7		< 1.7	
4-methylphenol		< .52		< .52		< .52	
Diethyl Phthalate		< 2		< 2		< 2	
Naphthalene		< .5		< .5		< .5	
Bis(2-ethylhexyl) Phthalate		< 4.8		< 4.8		5	
VOLATILE ORGANICS							
*1,2-dichloroethylenes (cis And Trans)		3.6		1.8		< .5	
1,1,1-trichloroethane		< .5		< .5		< .5	
Acetone		< 13		< 13		< 13	
Carbon Tetrachloride		< .58		< .58		< .58	
Chloroform		< .5		< .5		< .5	
Dichloromethane		< 2.3		< 2.3		< 2.3	
Ethylbenzene		< .5		< .5		< .5	
Styrene		< .5		< .5		< .5	
Tetrachloroethene		1.7		16		< 1.6	
Toluene		< .5		.6		< .5	
Trichloroethylene		1		1.9		< .5	
Xylenes		< .84		< .84		< .84	
WET CHEMISTRY							
Alkalinity		32000		14000		18000	
Chloride		8340		6040		44000	
Nitrite, Nitrate-non Specific		32.3		148		1800	
Nitrogen By Kjeldahl Method		514		333		< 183	
Phosphate		26.6		13.8		< 13.3	
Sulfate		16000		16000		25000	
Total Dissolved Solids		69000		72000		112000	
Total Hardness		12000		18400		< 1000	
Total Suspended Solids		15000		6000		20000	
OTHER							
Total Petroleum Hydrocarbons		< 181		< 187		< 170	

TABLE 2-7
RI GROUNDWATER OFF-SITE ANALYTICAL RESULTS
AOC 57

FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MASSACHUSETTS

Site ID: Sample Date: Field Sample Number: Lab Sample Number: Sample Date: Depth: Units:	Devens Background Concentrations µg/L	57M-95-04B MX5704B2 DV4W*459 02/14/96 23.5 µg/L	57M-95-05X MX5705X1 DV4F*175 11/02/95 15 µg/L	57M-95-05X MX5705X1 DV4W*175 11/02/95 15 µg/L	57M-95-05X MX5705X2 DV4F*176 02/13/96 15 µg/L	57M-95-05X MX5705X2 DV4W*176 02/13/96 15 µg/L	57M-95-06X MX5706X1 DV4F*177 11/02/95 16.9 µg/L
METALS							
Aluminum	6870	< 141	< 141 F	< 141	< 141 F	< 141	< 141 F
Arsenic	10.5	< 2.54	< 2.54 F	< 2.54	< 2.54 F	< 2.54	< 2.54 F
Barium	39.6	10.4	16.4 F	16	13.9 F	13	21.6 F
Cadmium	4.01	< 4.01	< 4.01 F	< 4.01	< 4.01 F	< 4.01	< 4.01 F
Calcium	14700	12700	5320 F	5290	5320 F	5010	8760 F
Copper	8.09	< 8.09	< 8.09 F	< 8.09	< 8.09 F	< 8.09	< 8.09 F
Iron	9100	< 38.8	47.4 F	< 38.8	< 38.8 F	< 38.8	< 38.8 F
Lead	4.25	< 1.26	< 1.26 F	< 1.26	< 1.26 F	< 1.26	< 1.26 F
Magnesium	3480	1390	< 500 F	522	507 F	< 500	668 F
Manganese	291	530	9.3 F	10	5.95 F	5.79	319 F
Potassium	2370	2800	1330 F	1560	1660 F	1560	2170 F
Sodium	10800	34900	11300 F	10700	10100 F	9000	7680 F
Zinc	21.1	< 21.1	< 21.1 F	< 21.1	< 21.1 F	< 21.1	< 21.1 F
PESTICIDES/PCBS							
Endosulfan Ii		< .023		< .023		< .023	
SEMIVOLATILE ORGANICS							
1,2-dichlorobenzene		< 1.7		< 1.7		< 1.7	
1,4-dichlorobenzene		< 1.7		< 1.7		< 1.7	
2-methylnaphthalene		< 1.7		< 1.7		< 1.7	
4-methylphenol		< .52		< .52		< .52	
Diethyl Phthalate		< 2		< 2		2.7	
Naphthalene		< .5		< .5		< .5	
Bis(2-ethylhexyl) Phthalate		400		7.7		< 4.8	
VOLATILE ORGANICS							
*1,2-dichloroethylenes (cis And Trans)		< .5		< .5		< .5	
1,1,1-trichloroethane		< .5		< .5		< .5	
Acetone		< 13		< 13		< 13	
Carbon Tetrachloride		< .58		< .58		< .58	
Chloroform		< .5		< .5		< .5	
Dichloromethane		< 2.3		< 2.3		< 2.3	
Ethylbenzene		< .5		< .5		< .5	
Styrene		< .5		< .5		< .5	
Tetrachloroethene		< 1.6		< 1.6		< 1.6	
Toluene		.9		< .5		1.2	
Trichloroethylene		< .5		< .5		< .5	
Xylenes		< .84		< .84		< .84	
WET CHEMISTRY							
Alkalinity		5330		12000		224000	
Chloride		63000		12100		13200	
Nitrite, Nitrate-non Specific		1700		950		870	
Nitrogen By Kjeldahl Method		< 183		< 183		< 183	
Phosphate		15		17.7		< 13.3	
Sulfate		21000		11000		< 10000	
Total Dissolved Solids		174000		42000		62000	
Total Hardness		41200		16000		17600	
Total Suspended Solids		< 4000		14000		< 4000	
OTHER							
Total Petroleum Hydrocarbons		< 191		< 176		< 179	

TABLE 2-7
RI GROUNDWATER OFF-SITE ANALYTICAL RESULTS
AOC 57

FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MASSACHUSETTS

Site ID: Sample Date: Field Sample Number: Lab Sample Number: Sample Date: Depth: Units:	Devens Background Concentrations µg/L	57M-95-06X MX5706X1 DV4W*177 11/02/95 16.9 µg/L		57M-95-06X MX5706X2 DV4F*178 02/15/96 16.9 µg/L		57M-95-06X MX5706X2 DV4W*178 02/15/96 16.9 µg/L		57M-95-07X MX5707X1 DV4F*179 10/31/95 8 µg/L		57M-95-07X MX5707X1 DV4W*179 10/31/95 8 µg/L		57M-95-07X MX5707X2 DV4F*180 02/14/96 8 µg/L	
METALS													
Aluminum	6870	2480		167	F	204		< 141	F	< 141		< 141	F
Arsenic	10.5	6.93		< 2.54	F	< 2.54		< 2.54	F	< 2.54		< 2.54	F
Barium	39.6	34.3		17.2	F	18.6		23.1	F	23		9.06	F
Cadmium	4.01	< 4.01		< 4.01	F	< 4.01		< 4.01	F	< 4.01		< 4.01	F
Calcium	14700	9540		4660	F	4790		4450	F	4410		2590	F
Copper	8.09	< 8.09		< 8.09	F	< 8.09		< 8.09	F	< 8.09		< 8.09	F
Iron	9100	2790		< 38.8	F	< 38.8		< 38.8	F	< 38.8		< 38.8	F
Lead	4.25	2.17		< 1.26	F	< 1.26		9	F	9.65		< 1.26	F
Magnesium	3480	1380		< 500	F	< 500		< 500	F	< 500		< 500	F
Manganese	291	355		173	F	177		18.2	F	19.2		20.9	F
Potassium	2370	2700		1350	F	1320		1050	F	917		775	F
Sodium	10800	7670		2760	F	2800		23700	F	22700		10400	F
Zinc	21.1	31		< 21.1	F	< 21.1		< 21.1	F	< 21.1		< 21.1	F
PESTICIDES/PCBS													
Endosulfan Ii		.0271	C			< .023				< .023			
SEMIVOLATILE ORGANICS													
1,2-dichlorobenzene		< 1.7				< 1.7				< 1.7	N		
1,4-dichlorobenzene		< 1.7				< 1.7				< 1.7	N		
2-methylnaphthalene		< 1.7				< 1.7				< 1.7	N		
4-methylphenol		< .52				< .52				< .52	N		
Diethyl Phthalate		< 2				< 2				< 2	N		
Naphthalene		< .5				< .5				< .5	N		
Bis(2-ethylhexyl) Phthalate		< 4.8				< 4.8				< 4.8	N		
VOLATILE ORGANICS													
*1,2-dichloroethylenes (cis And Trans)		< .5				< .5				< .5			
1,1,1-trichloroethane		< .5				< .5				< .5			
Acetone		< 13				< 13				< 13			
Carbon Tetrachloride		< .58				< .58				< .58			
Chloroform		< .5				< .5				< .5			
Dichloromethane		< 2.3				< 2.3				< 2.3			
Ethylbenzene		< .5				< .5				< .5			
Styrene		< .5				< .5				< .5			
Tetrachloroethene		< 1.6				< 1.6				4			
Toluene		< .5				< .5				< .5			
Trichloroethylene		< .5				< .5				< .5			
Xylenes		< .84				< .84				< .84			
WET CHEMISTRY													
Alkalinity		10000				< 5000				7000			
Chloride		7570				< 2120				28500			
Nitrite, Nitrate-non Specific		1600				2000				570			
Nitrogen By Kjeldahl Method		< 183				< 183				< 183			
Phosphate		< 13.3				< 13.3				< 13.3			
Sulfate		19000				< 10000				< 10000			
Total Dissolved Solids		42000				55000				74000			
Total Hardness		2000				13200				16000			
Total Suspended Solids		19000				< 4000				5000			
OTHER													
Total Petroleum Hydrocarbons		< 172				< 177				< 167			

TABLE 2-7
RI GROUNDWATER OFF-SITE ANALYTICAL RESULTS
AOC 57

FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MASSACHUSETTS

Site ID Sample Date:	Devens	57M-95-07X	57M-95-08A	57M-95-08A	57M-95-08A	57M-95-08A	57M-95-08B
Field Sample Number:		MX5707X2	MX5708A1	MX5708A1	MX5708A2	MX5708A2	MX5708B1
Lab Sample Number:		DV4W*180	DV4F*181	DV4W*181	DV4F*182	DV4W*182	DV4F*183
Sample Date:	Background	02/14/96	11/01/95	11/01/95	02/15/96	02/15/96	11/01/95
Depth:	Concentrations	8	8	8	8	8	23
Units:	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
METALS							
Aluminum	6870	< 141	< 141 F	< 141	< 141 F	< 141	< 141 F
Arsenic	10.5	< 2.54	< 2.54 F	< 2.54	< 2.54 F	< 2.54	< 2.54 F
Barium	39.6	9.19	16.8 F	13.7	16.8 F	15.2	9.35 F
Cadmium	4.01	< 4.01	< 4.01 F	< 4.01	< 4.01 F	< 4.01	< 4.01 F
Calcium	14700	2660	8320 F	7040	7480 F	6940	14100 F
Copper	8.09	< 8.09	< 8.09 F	< 8.09	< 8.09 F	< 8.09	< 8.09 F
Iron	9100	< 38.8	< 38.8 F	146	413 F	712	< 38.8 F
Lead	4.25	< 1.26	< 1.26 F	< 1.26	< 1.26 F	< 1.26	< 1.26 F
Magnesium	3480	< 500	843 F	779	842 F	765	1500 F
Manganese	291	21.4	2420 F	1740	819 F	724	30 F
Potassium	2370	809	1450 F	1350	1380 F	704	2360 F
Sodium	10800	10500	4440 F	3880	4310 F	4010	28900 F
Zinc	21.1	< 21.1	< 21.1 F	< 21.1	< 21.1 F	< 21.1	< 21.1 F
PESTICIDES/PCBS							
Endosulfan Ii		< .023		< .023		< .023	
SEMIVOLATILE ORGANICS							
1,2-dichlorobenzene		< 1.7		< 1.7		< 1.7	
1,4-dichlorobenzene		< 1.7		< 1.7		< 1.7	
2-methylnaphthalene		< 1.7		< 1.7		< 1.7	
4-methylphenol		< .52		< .52		< .52	
Diethyl Phthalate		< 2		< 2		< 2	
Naphthalene		< .5		< .5		< .5	
Bis(2-ethylhexyl) Phthalate		< 4.8		< 4.8		< 4.8	
VOLATILE ORGANICS							
*1,2-dichloroethylenes (cis And Trans)		< .5		< .5		< .5	
1,1,1-trichloroethane		< .5		< .5		< .5	
Acetone		< 13		19		< 13	
Carbon Tetrachloride		< .58		< .58		< .58	
Chloroform		< .5		< .5		< .5	
Dichloromethane		< 2.3		< 2.3		< 2.3	
Ethylbenzene		< .5		< .5		< .5	
Styrene		< .5		< .5		< .5	
Tetrachloroethene		3.9		< 1.6		< 1.6	
Toluene		.58		< .5		< .5	
Trichloroethylene		< .5		< .5		< .5	
Xylenes		< .84		< .84		< .84	
WET CHEMISTRY							
Alkalinity		6000		15000		14000	
Chloride		11000		4060		5160	
Nitrite, Nitrate-non Specific		1400		360		290	
Nitrogen By Kjeldahl Method		< 183		181		< 183	
Phosphate		< 13.3		19		< 13.3	
Sulfate		< 10000		11000		10000	
Total Dissolved Solids		51000		25000		70000	
Total Hardness		10800		2000		2000	
Total Suspended Solids		8000		4000		4000	
OTHER							
Total Petroleum Hydrocarbons		< 195		< 180		< 183	

TABLE 2-7
RI GROUNDWATER OFF-SITE ANALYTICAL RESULTS
AOC 57

FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MASSACHUSETTS

Site ID: Sample Date: / Field Sample Number: / Lab Sample Number: / Sample Date: / Depth: / Units:	Devens Background Concentrations µg/L	57M-95-08B / MX5708B1 / DV4W*183 / 11/01/95 / 23 / µg/L	57M-95-08B / MX5708B2 / DV4F*462 / 02/15/96 / 23 / µg/L	57M-95-08B / MX5708B2 / DV4W*462 / 02/15/96 / 23 / µg/L	57M-95-03X / MD5703X2 / DV4F*458 / 02/14/96 / 12 / µg/L	57M-95-03X / MD5703X2 / DV4W*458 / 02/14/96 / 12 / µg/L
METALS						
Aluminum	6870	1770	< 141 F	< 141	< 141 DF	263 D
Arsenic	10.5	< 2.54	< 2.54 F	< 2.54	36.6 DF	27.5 D
Barium	39.6	11.4	7.56 F	7.31	37.4 DF	47.6 D
Cadmium	4.01	< 4.01	< 4.01 F	< 4.01	< 4.01 DF	< 4.01 D
Calcium	14700	17400	12700 F	13600	10100 DF	8890 D
Copper	8.09	39.1	< 8.09 F	< 8.09	< 8.09 DF	< 8.09 D
Iron	9100	2150	< 38.8 F	< 38.8	10600 DF	7400 D
Lead	4.25	9.76	< 1.26 F	< 1.26	< 1.26 DF	< 1.26 D
Magnesium	3480	1910	1340 F	1460	775 DF	758 D
Manganese	291	81.3	9.97 F	10.9	351 DF	277 D
Potassium	2370	1930	1260 F	1410	1860 DF	1830 D
Sodium	10800	30000	29800 F	30700	1950 DF	1650 D
Zinc	21.1	< 21.1	< 21.1 F	< 21.1	46.3 DF	63.6 D
PESTICIDES/PCBS						
Endosulfan Ii		< .023		< .023		< .023 D
SEMIVOLATILE ORGANICS						
1,2-dichlorobenzene		< 1.7		< 1.7		< 1.7 D
1,4-dichlorobenzene		< 1.7		< 1.7		< 1.7 D
2-methylnaphthalene		< 1.7		< 1.7		< 1.7 D
4-methylphenol		< .52		< .52		< .52 D
Diethyl Phthalate		< 2		< 2		< 2 D
Naphthalene		< .5		< .5		2.6 D
Bis(2-ethylhexyl) Phthalate		6.9		300		300 D
VOLATILE ORGANICS						
*1,2-dichloroethylenes (cis And Trans)		< .5		< .5		< .5 D
1,1,1-trichloroethane		< .5		< .5		< .5 D
Acetone		< 13		< 13		< 13 D
Carbon Tetrachloride		< .58		< .58		< .58 D
Chloroform		< .5		< .5		< .5 D
Dichloromethane		< 2.3		< 2.3		< 2.3 D
Ethylbenzene		< .5		< .5		1.9 D
Styrene		< .5		< .5		< .5 D
Tetrachloroethene		< 1.6		< 1.6		< 1.6 D
Toluene		< .5		.53		1.8 D
Trichloroethylene		1.5		1.8		< .5 D
Xylenes		< .84		< .84		8.3 D
WET CHEMISTRY						
Alkalinity		15000		6000		38000 D
Chloride		53000		46000		< 2120 D
Nitrite, Nitrate-non Specific		1600		1800		270 D
Nitrogen By Kjeldahl Method		276		< 183		419 D
Phosphate		28.5		< 13.3		< 13.3 D
Sulfate		22000		21000		< 10000 D
Total Dissolved Solids		120000		160000		81000 D
Total Hardness		52000		51200		28400 D
Total Suspended Solids		19000		< 4000		12000 D
OTHER						
Total Petroleum Hydrocarbons		< 178		< 183		< 187 D

TABLE 2-7
RI GROUNDWATER OFF-SITE ANALYTICAL RESULTS
AOC 57

FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MASSACHUSETTS

Site ID: Sample Date: Field Sample Number: Lab Sample Number: Sample Date: Depth: Units:	Devens Background Concentrations µg/L	57M-95-03X MX5703X1 DV4F*171 11/02/95 12 µg/L	57M-95-03X MX5703X1 DV4W*171 11/02/95 12 µg/L	57M-95-03X MX5703X2 DV4F*172 02/14/96 12 µg/L	57M-95-03X MX5703X2 DV4W*172 02/14/96 12 µg/L	57M-95-03X MX5703X3 DV4W*537 10/02/96 12 µg/L	57M-96-09X MX5709X1 DV4W*533 10/01/96 0 µg/L
METALS							
Aluminum	6870	< 141 F	< 141	< 141 F	< 141	85	190
Arsenic	10.5	71 F	74	40.1 F	42.3	33.2	< 2.54
Barium	39.6	26.4 F	25.1	36.4 F	37.4	87.2	17.6
Cadmium	4.01	< 4.01 F	< 4.01	< 4.01 F	< 4.01	8.67	< 3.01
Calcium	14700	18600 F	18200	9820 F	9740	7940	8150
Copper	8.09	< 8.09 F	< 8.09	< 8.09 F	< 8.09	< 5	< 5
Iron	9100	17500 F	17800	11300 F	11700	12400	191
Lead	4.25	2.39 F	< 1.26	< 1.26 F	< 1.26	< 1.26	< 1.26
Magnesium	3480	846 F	880	712 F	715	< 1000	1110
Manganese	291	699 F	687	343 F	348	466	19.6
Potassium	2370	2970 F	2500	2370 F	2130	2400	1550
Sodium	10800	2190 F	2130	1910 F	1840	< 2290	< 2290
Zinc	21.1	< 21.1 F	< 21.1	43.3 F	42.8	192	< 35.8
PESTICIDES/PCBS							
Endosulfan Ii			< .023		< .023	< .023	< .023
SEMIVOLATILE ORGANICS							
1,2-dichlorobenzene			7		< 1.7	9.8	< 1.7
1,4-dichlorobenzene			5		< 1.7	5.6	< 1.7
2-methylnaphthalene			< 3		< 1.7	4.4	< 1.7
4-methylphenol			< 1		< .52	1.5	< .52
Diethyl Phthalate			< 4		< 2	< 2	< 2
Naphthalene			20		2.8	20	< .5
Bis(2-ethylhexyl) Phthalate			< 10		< 4.8	< 4.8	< 4.8
VOLATILE ORGANICS							
*1,2-dichloroethylenes (cis And Trans)			< .5		< .5	< .5	< .5
1,1,1-trichloroethane			< .5		< .5	< .5	< .5
Acetone			< 13		< 13	< 13	< 13
Carbon Tetrachloride			< .58		< .58	4.5	< .58
Chloroform			< .5		< .5	10	< .5
Dichloromethane			< 2.3		< 2.3	2.9	< 2.3
Ethylbenzene			47		1.9	46	< .5
Styrene			< .5		< .5	< .5	< .5
Tetrachloroethene			3.7		< 1.6	2.6	< 1.6
Toluene			49		1.9	19	< .5
Trichloroethylene			< .5		< .5	.59	< .5
Xylenes			200 X		9.3	200	< .84
WET CHEMISTRY							
Alkalinity			56000		38200		
Chloride			3510		< 2120		
Nitrite, Nitrate-non Specific			1100		260	158	
Nitrogen By Kjeldahl Method			733		495	324	< 183
Phosphate			240		21.9	16.2	28.6
Sulfate			< 10000		< 10000		
Total Dissolved Solids			72000		78000	86000	40000
Total Hardness			14000		26800	1660000000	33600000
Total Suspended Solids			162000		12000	8000	19000
OTHER							
Total Petroleum Hydrocarbons			337		< 197	< 167000	< 167

TABLE 2-7
RI GROUNDWATER OFF-SITE ANALYTICAL RESULTS
AOC 57

FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MASSACHUSETTS

Site ID: Sample Date: / Field Sample Number: / Lab Sample Number: / Sample Date: / Depth: / Units:	Devens Background Concentrations µg/L	57M-96-10X / MX5710X1 / DV4W*434 / 10/02/96 / 0 / µg/L		57M-96-11X / MD5711X1 / DV4W*305 / 10/02/96 / 0 / µg/L		57M-96-11X / MX5711X1 / DV4W*535 / 10/02/96 / 0 / µg/L	57M-96-12X / MX5712X1 / DV4W*306 / 10/02/96 / 0 / µg/L	57M-96-13X / MX5713X1 / DV4W*307 / 10/02/96 / 0 / µg/L	G3M-92-02X / MXG302X1 / DV4F*163 / 10/31/95 / 26 / µg/L	
METALS										
Aluminum	6870	183		200	D	161	2 2450	65.2	< 141	F
Arsenic	10.5	< 2.54		170	D	170	3.73	8.96	< 2.54	F
Barium	39.6	36.1		11.6	D	11	41.8	12.1	12.3	F
Cadmium	4.01	< 3.01		< 3.01	D	< 3.01	< 3.01	< 3.01	< 4.01	F
Calcium	14700	2020		9730	D	9310	9110	16900	6780	F
Copper	8.09	< 5		< 5	D	< 5	< 5	< 5	< 8.09	F
Iron	9100	105		26500	D	25900	1540	1910	< 38.8	F
Lead	4.25	< 1.26		< 1.26	D	< 1.26	< 1.26	< 1.26	< 1.26	F
Magnesium	3480	< 1000		1190	D	1190	1080	< 1000	584	F
Manganese	291	206		2100	D	1990	126	346	6.68	F
Potassium	2370	< 1000		1920	D	1680	1730	1650	1110	F
Sodium	10800	< 2290		4050	D	3990	5050	2850	20300	F
Zinc	21.1	37.2		< 35.8	D	< 35.8	< 35.8	< 35.8	< 21.1	F
PESTICIDES/PCBS										
Endosulfan Ii		< .023	K	< .023	D	< .023	< .023	< .023		
SEMIVOLATILE ORGANICS										
1,2-dichlorobenzene		< 1.7	V K	3.4	D	2.6	< 1.7	< 1.7		
1,4-dichlorobenzene		< 1.7	V K	< 1.7	D	< 1.7	< 1.7	< 1.7		
2-methylnaphthalene		< 1.7	V K	< 1.7	D	< 1.7	< 1.7	< 1.7		
4-methylphenol		< .52	V K	< .52	D	< .52	< 0.52	5		
Diethyl Phthalate		< 2	V K	< 2	D	< 2	< 0.2	< 2		
Naphthalene		< .5	V K	3.3	D	2.5	< 0.5	< .5		
Bis(2-ethylhexyl) Phthalate		< 4.8	V K	6.7	D	< 4.8	< 4.8	< 4.8		
VOLATILE ORGANICS										
*1,2-dichloroethylenes (cis And Trans)		< .5		.89	D	.74	< .5	< .5		
1,1,1-trichloroethane		< .5		< .5	D	< .5	< .5	< .5		
Acetone		< 13		< 13	D	< 13	< 13	< 13		
Carbon Tetrachloride		< .58		< .58	D	< .58	< .58	< .58		
Chloroform		< .5		< .5	D	< .5	< .5	< .5		
Dichloromethane		< 2.3		< 2.3	D	< 2.3	< 2.3	< 2.3		
Ethylbenzene		< .5		4.6	D	4.2	< .5	2.8		
Styrene		< .5		< .5	D	< .5	< .5	8		
Tetrachloroethene		< 1.6		4.8	D	4.7	< 1.6	< 1.6		
Toluene		< .5		.67	D	.86	1.1	2.9		
Trichloroethylene		< .5		1.1	D	1.1	< .5	< .5		
Xylenes		< .84		6.5	D	6.8	< .84	< .84		
WET CHEMISTRY										
Alkalinity										
Chloride										
Nitrite, Nitrate-non Specific		54				< 10	17.1	132		
Nitrogen By Kjeldahl Method		< 183		390	D	448	< 183	< 183		
Phosphate		< 13.3		70.8	D	65.6	55.2	< 13.3		
Sulfate										
Total Dissolved Solids		26000		93000	D	86000	58000	67000		
Total Hardness		10800000		1140000000	D	1610000000	35200000	104000000		
Total Suspended Solids		< 4000		25000	D	26000	101000	4000		
OTHER										
Total Petroleum Hydrocarbons		< 167		< 169	D	< 167	< 167	< 167		

TABLE 2-7
RI GROUNDWATER OFF-SITE ANALYTICAL RESULTS
AOC 57

FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MASSACHUSETTS

Site ID: Sample Date: Field Sample Number: Lab Sample Number: Sample Date: Depth: Units:	Devens Background Concentrations µg/L	G3M-92-02X MXG302X1 DV4W*163 10/31/95 26 µg/L		G3M-92-02X MXG302X2 DV4F*164 02/12/96 26 µg/L		G3M-92-02X MXG302X2 DV4W*164 02/12/96 26 µg/L		G3M-92-07X MDG307X1 DV4F*448 10/31/95 27 µg/L		G3M-92-07X MDG307X1 DV4W*448 10/31/95 27 µg/L		G3M-92-07X MXG307X1 DV4F*165 10/31/95 27 µg/L	
METALS													
Aluminum	6870	< 141		< 141	F	< 141		< 141	D	168	D	< 141	F
Arsenic	10.5	< 2.54		< 2.54	F	< 2.54		< 2.54	DF	< 2.54	D	< 2.54	F
Barium	39.6	12.3		34.6	F	33		15.4	D	15.9	D	15.6	F
Cadmium	4.01	< 4.01		< 4.01	F	< 4.01		< 4.01	D	< 4.01	D	< 4.01	F
Calcium	14700	6860		10100	F	10200		11700	D	11900	D	11900	F
Copper	8.09	< 8.09		< 8.09	F	< 8.09		< 8.09	D	< 8.09	D	< 8.09	F
Iron	9100	93.5		< 38.8	F	< 38.8		< 38.8	D	247	D	< 38.8	F
Lead	4.25	< 1.26		< 1.26	F	< 1.26		< 1.26	DF	< 1.26	D	< 1.26	F
Magnesium	3480	588		895	F	883		652	D	664	D	652	F
Manganese	291	7.54		9.16	F	7.82		< 2.75	D	6.88	D	< 2.75	F
Potassium	2370	1280		2490	F	1700		2210	D	2110	D	2090	F
Sodium	10800	21700		49100	F	50800		39100	D	39100	D	38700	F
Zinc	21.1	< 21.1		< 21.1	F	< 21.1		< 21.1	D	< 21.1	D	< 21.1	F
PESTICIDES/PCBS													
Endosulfan Ii		< .023				< .023				< .023	D		
SEMIVOLATILE ORGANICS													
1,2-dichlorobenzene		< 1.7	N			< 1.7				< 1.7	D N		
1,4-dichlorobenzene		< 1.7	N			< 1.7				< 1.7	D N		
2-methylnaphthalene		< 1.7	N			< 1.7				< 1.7	D N		
4-methylphenol		< .52	N			< .52				< .52	D N		
Diethyl Phthalate		< 2	N			3.4				< 2	D N		
Naphthalene		< .5	N			< .5				< .5	D N		
Bis(2-ethylhexyl) Phthalate		< 4.8	N			< 4.8				< 4.8	D N		
VOLATILE ORGANICS													
*1,2-dichloroethylenes (cis And Trans)		< .5				< .5				< .5	D		
1,1,1-trichloroethane		< .5				< .5				< .5	D		
Acetone		< 13				< 13				< 13	D		
Carbon Tetrachloride		< .58				< .58				< .58	D		
Chloroform		< .5				< .5				< .5	D		
Dichloromethane		< 2.3				< 2.3				< 2.3	D		
Ethylbenzene		< .5				< .5				< .5	D		
Styrene		< .5				< .5				< .5	D		
Tetrachloroethene		< 1.6				< 1.6				< 1.6	D		
Toluene		< .5				< .5				< .5	D		
Trichloroethylene		< .5				< .5				< .5	D		
Xylenes		< .84				< .84				< .84	D		
WET CHEMISTRY													
Alkalinity		10000				5000				13000	D		
Chloride		35000				93000				66000	D		
Nitrite, Nitrate-non Specific		1500				1300				1000	D		
Nitrogen By Kjeldahl Method		< 183				< 183				181	D		
Phosphate		< 13.3				< 13.3				< 13.3	D		
Sulfate		< 10000				11000				15000	D		
Total Dissolved Solids		93000				195000				169000	D		
Total Hardness		20000				30400				36000	D		
Total Suspended Solids		< 4000				< 4000				< 4000	D		
OTHER													
Total Petroleum Hydrocarbons		< 183				< 181				< 181	D		

TABLE 2-7
RI GROUNDWATER OFF-SITE ANALYTICAL RESULTS
AOC 57

FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MASSACHUSETTS

Site ID: Sample Date: / Field Sample Number: / Lab Sample Number: / Sample Date: / Depth: / Units:	Devens Background Concentrations µg/L	G3M-92-07X MXG307X1 DV4W*165 10/31/95 27 µg/L	G3M-92-07X MXG307X2 DV4F*166 02/13/96 27 µg/L	G3M-92-07X MXG307X2 DV4W*166 02/13/96 27 µg/L	G3M-92-07X MXG307X3 DV4W*536 10/01/96 0 µg/L
METALS					
Aluminum	6870	< 141	< 141 F	< 141	41.4
Arsenic	10.5	< 2.54	< 2.54 F	< 2.54	< 2.54
Barium	39.6	15.4	16.4 F	15.9	28.3
Cadmium	4.01	< 4.01	< 4.01 F	< 4.01	< 3.01
Calcium	14700	11800	9580 F	9480	15200
Copper	8.09	< 8.09	< 8.09 F	< 8.09	5.14
Iron	9100	135	< 38.8 F	< 38.8	< 36.8
Lead	4.25	< 1.26	< 1.26 F	< 1.26	< 1.26
Magnesium	3480	668	591 F	541	< 1000
Manganese	291	2.99	< 2.75 F	< 2.75	< 2.5
Potassium	2370	2240	2430 F	1740	2440
Sodium	10800	38400	42300 F	42900	52000
Zinc	21.1	< 21.1	< 21.1 F	< 21.1	43
PESTICIDES/PCBS					
Endosulfan Ii		< .023		< .023	< .023
SEMIVOLATILE ORGANICS					
1,2-dichlorobenzene		< 1.7 N		< 1.7	< 1.7
1,4-dichlorobenzene		< 1.7 N		< 1.7	< 1.7
2-methylnaphthalene		< 1.7 N		< 1.7	< 1.7
4-methylphenol		< .52 N		< .52	< .52
Diethyl Phthalate		2.4 N		< 2	< 2
Naphthalene		< .5 N		< .5	< .5
Bis(2-ethylhexyl) Phthalate		< 4.8 N		< 4.8	12
VOLATILE ORGANICS					
*1,2-dichloroethylenes (cis And Trans)		< .5		< .5	< .5
1,1,1-trichloroethane		< .5		< .5	< .5
Acetone		< 13		< 13	< 13
Carbon Tetrachloride		< .58		< .58	< .58
Chloroform		.53		< .5	< .5
Dichloromethane		< 2.3		< 2.3	< 2.3
Ethylbenzene		< .5		< .5	< .5
Styrene		< .5		< .5	< .5
Tetrachloroethene		< 1.6		< 1.6	< 1.6
Toluene		< .5		.89	< .5
Trichloroethylene		< .5		< .5	< .5
Xylenes		< .84		< .84	< .84
WET CHEMISTRY					
Alkalinity		12000		320000	
Chloride		66000		71000	
Nitrite, Nitrate-non Specific		1300		1900	
Nitrogen By Kjeldahl Method		< 183		343	< 183
Phosphate		18.2		< 13.3	< 13.3
Sulfate		15000		13000	
Total Dissolved Solids		172000		174000	216000
Total Hardness		34000		27200	48800000
Total Suspended Solids		< 4000		9000	< 4000
OTHER					
Total Petroleum Hydrocarbons		< 181		< 189	< 167000

Notes:
< = Concentration was less than the certified reporting limit
D = Duplicate Sample
T = Non-target compound analyzed for and not detected (non-GC/MS method)
I = Interferences in the sample caused the quantitation and/or identification to be suspect
M = High duplicate spike not within control limits
J = Value is estimated
F = Filtered Sample
X =Analyte concentration above reporting limit

TABLE 2-8
1998 GROUNDWATER FIELD AND OFF-SITE ANALYTICAL RESULTS
AOC 57

FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MASSACHUSETTS

		Area 2		Area 3							
Parameter	Units	57P-98-02X MX5702XX 5/26/98	57P-98-02X MX5702XX 5/26/98	57M-96-11X MX5711XX 5/27/98	57M-96-11X MX5711XX 5/27/98	57M-96-11X MD5711XX 5/27/98	57M-96-11X MD5711XX 5/27/98	57P-98-03X MX5703XX 5/26/98	57P-98-03X MX5703XX 5/26/98	57P-98-04X MX5704XX 5/26/98	57P-98-04X MX5704XX 5/26/98
Volatile Organics GC/MS											
*1,2-dichloroethylenes (cis And Trans)	µg/L	13		LT 0.5		LT 0.5 d		LT 0.5		LT 0.5	
Chlorobenzene	µg/L	LT 0.5		LT 0.5		LT 0.5 d		LT 0.5		0.88	
Ethylbenzene	µg/L	LT 0.5		20		20 d		3.2		LT 0.5	
Toluene	µg/L	0.54		LT 0.5		LT 0.5 d		LT 0.5		LT 0.5	
Methylcyclohexane	µg/L										
Tetrachloroethene	µg/L	LT 1.6		5.4		5.5 d		LT 1.6		LT 1.6	
Trichloroethylene	µg/L	0.71		3.7		3.8 d		LT 0.5		LT 0.5	
Xylenes	µg/L	LT 0.84		5.9		5.8 d		5 s		LT 0.84	
Semivolatile Organics by GC/MS											
1,2-dichlorobenzene	µg/L	LT 1.7		6.4		3.9 d		4.9		LT 1.7	
1,4-dichlorobenzene	µg/L	LT 1.7		2.7		LT 1.7 d		LT 1.7		LT 1.7	
2-methylnaphthalene	µg/L	LT 1.7		LT 1.7		LT 1.7 d		2		LT 1.7	
bis(2-ethylhexyl) Phthalate	µg/L	6.4		LT 4.8		LT 4.8 d		52		5.8	
Naphthalene	µg/L	LT 0.5		6.2		3.3 d		8 s		LT 0.5	
Metals											
Arsenic	µg/L	54.4	73f	84.4	133f	83.6 d	138 df	13.4	20.9f	7.68	12.7f
Barium	µg/L	16.4	16f	18	9.2f	41.8 d	8.8 df	10.2	7.2f	8.4	6.4f
Copper	µg/L	LT 5	LT 5f	LT 5	LT 5f	8.54 d	LT 5 df	LT 5	LT 5f	LT 5	LT 5f
Lead	µg/L	16.0	4.40f	LT 1.00	LT 1.00f	8.07	LT 1.00f	1.85	LT 1.00f	3.76	LT 1.00f
Manganese	µg/L	439 RJ	434 RJf	2640 RJ	2660 RJf	2460 d RJ	2380 d RJf	690 RJ	754 RJf	1480 RJ	1420 RJf
Total Suspended Solids	µg/L	110000		2120000		46700 d		312000		633000	
VPH Ranges (µg/L)											
n-C5 to n-C8 Aliphatic	µg/L	<20		91		88		<20		<20	
n-C9 to n-C12 Aliphatic	µg/L	<20		75j		<20j		<20		<20	
n-C9 to n-C10 Aromatic	µg/L	<20		93j		250j		310		<20	
EPH Ranges (µg/L)											
n-C9 to n-C18 Aliphatic	µg/L	<500j		<500j		<500j		<500j		<500j	
n-C19 to n-C36 Aliphatic	µg/L	<500		<500		<500		<500		<500	
n-C11 to n-C22 Aromatic	µg/L	<200		<200j		<200j		<200		<200	
On-Site TPH (mg/L)	mg/L	<50		<50		<50		<50		<50	

Notes:
Flag codes are in small case letters following result
d = duplicate sample result
f = filtered result
Data qualifiers are in capital letters following result
R = Rejected data, J = low blank spike recovery in this lot was low
j = estimated
= exceeds established Devens background concentrations

TABLE 2-9
CONFIRMATORY SAMPLING RESULTS
AOC 57 AREA 3 REMOVAL ACTION
AOC 57

FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MASSACHUSETTS

SAMPLE ID / DATE COLLECTED	MCP S-1/GW-1 (mg/kg)	MCP S-2/GW-3 (mg/kg)	RISK BASED SURFACE (mg/kg)	RISK BASED SUBSURFACE (mg/kg)	EX57W01X 2.5 ft bgs 25-Mar-99	EX57W02X 3 ft bgs 25-Mar-99	ED57W02X 3 ft bgs 25-Mar-99	EX57W03X 3 ft bgs 25-Mar-99	EX57W04X 3 ft bgs 25-Mar-99	EX57W05X 3 ft bgs 25-Mar-99	EX57W06X 5 ft bgs 25-Mar-99	EX57W07X 5 ft bgs 25-Mar-99	EX57W08X 5 ft bgs 25-Mar-99	EX57W09X 4 ft bgs 16-Apr-99	EX57W10X 3 ft bgs 16-Apr-99
VPH (mg/kg)															
n-C5 to n-C8 Aliphatic	100	500			<20	<23	<20	<19	<20	<19	<18	<18	<18	<15	<15
n-C9 to n-C12 Aliphatic	1000	2500			<4.9	<<5.8	<4.9	<4.8	<4.9	<4.7	<4.6	<4.5	<4.5	<3.7	<3.8
n-C9 to n-C10 Aromatic	100	500			<4.9	<5.8J	6.8J	<4.8	<4.9	<4.7	<4.6	<4.5	<4.5	<3.7	<3.8
Benzene	10	60			<2.5	<2.9	<2.4	<2.4	<2.4	<2.4	<2.3	<2.3	<2.2	<1.8	<1.9
Ethylbenzene	80	80			<2.5	<2.9	<2.4	<2.4	<2.4	<2.4	<2.3	<2.3	<2.2	<1.8	<1.9
m,p-Xylene	500*	1000*			<9.9	<12	<9.8	<9.5	<9.8	<9.5	<9.3	<9.1	<8.9	<7.4	<7.6
MTBE	0.3	200			<7.4	<8.8	<7.4	<7.1	<7.3	<7.1	<7.0	<6.8	<6.7	<5.6	<5.7
Naphthalene	4	1000			<4.9	<5.8	<4.9	<4.8	<4.9	<4.7	<4.6	<4.5	<4.5	<3.7	<3.8
o-Xylene	500*	1000*			<4.9	<5.8	<4.9	<4.8	<4.9	<4.7	<4.6	<4.5	<4.5	<3.7	<3.8
Toluene	90	1000			<7.4	<8.8	<7.4	<7.1	<7.3	<7.1	<7.0	<6.8	<6.7	<5.6	<5.7
EPH (mg/kg)															
n-C9 to n-C18 Aliphatic	1000	2500	NA	NA	50	<7.1	<7.4	11	61	<6.4	<6.4	9	<6.3	<6.3	<6.9
n-C19 to n-C36 Aliphatic	2500	5000	20000	20000	660	<7.1	<11	420	1700	<6.4	<20	440	<10	<6.3	<6.9
n-C11 to n-C22 Aromatic	200	2000	5000	10000	64	<19	<20	200	380	<17	<17	37	<17	<17	<18
2-Methylnaphthalene	4	1000			<1.8	<1.8	<1.8	<1.7	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6	<1.7
Acenaphthene	20	2000			<1.8	<1.8	<1.8	<1.7	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6	<1.7
Acenaphthylene	100	1000			<1.8	<1.8	<1.8	<1.7	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6	<1.7
Anthracene	1000	2500			<1.8	<1.8	<1.8	<1.7	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6	<1.7
Benzo(a)anthracene	0.7	1			<1.8	<1.8	<1.8	<1.7	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6	<1.7
Benzo(a)pyrene	0.7	0.7			<1.8	<1.8	<1.8	<1.7	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6	<1.7
Benzo(b)fluoranthene	0.7	1			<1.8	<1.8	<1.8	<1.7	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6	<1.7
Benzo(g,h,i)perylene	1000	2500			<1.8	<1.8	<1.8	<1.7	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6	<1.7
Benzo(k)fluoranthene	7	10			<1.8	<1.8	<1.8	<1.7	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6	<1.7
Chrysene	7	10			<1.8	<1.8	<1.8	<1.7	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6	<1.7
Dibenzo(a,h)anthracene	0.7	0.7			<1.8	<1.8	<1.8	<1.7	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6	<1.7
Fluoranthene	1000	600			<1.8	<1.8	<1.8	<1.7	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6	<1.7
Fluorene	400	1000			<1.8	<1.8	<1.8	<1.7	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6	<1.7
Indeno(1,2,3-cd)pyrene	0.7	1			<1.8	<1.8	<1.8	<1.7	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6	<1.7
Naphthalene	4	1000			<1.8J	<1.8J	<1.8J	<1.7J	<1.6J	<1.6J	<1.6J	<1.6J	<1.6J	<1.6J	<1.7
Phenanthrene	700	100			<1.8	<1.8	<1.8	<1.7	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6	<1.7
Pyrene	700	2000			<1.8	<1.8	<1.8	<1.7	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6	<1.7
PCBs (mg/kg)															
PCB-1016	2	2	2	4	<0.020	<0.020	<0.020	<0.020	<0.019	<0.019	<0.019	<0.019	<0.017	<0.017	<0.020
PCB-1221	2	2	2	4	<0.040	<0.040	<0.040	<0.040	<0.036	<0.036	<0.036	<0.036	<0.033	<0.033	<0.040
PCB-1232	2	2	2	4	<0.020	<0.020	<0.020	<0.020	<0.019	<0.019	<0.019	<0.019	<0.017	<0.017	<0.020
PCB-1242	2	2	2	4	<0.020	<0.020	<0.020	<0.020	<0.019	<0.019	<0.019	<0.019	<0.017	<0.017	<0.020
PCB-1248	2	2	2	4	<0.020	<0.020	<0.020	<0.020	<0.019	<0.019	<0.019	<0.019	<0.017	<0.017	<0.020
PCB-1254	2	2	2	4	<0.020	<0.020	<0.020	<0.020	<0.019	<0.019	<0.019	<0.019	<0.017	<0.017	<0.020
PCB-1260	2	2	2	4	1.3	<0.020	<0.020	2.8	0.43	<0.019	0.039	0.88	<0.017	0.025	<0.020
PESTICIDES (mg/kg)															
alpha-BHC					<0.020	<0.002	<0.002	<0.020	<0.073	<0.0019	<0.0019	<0.0019	<0.0017	<0.0017	<0.002
gamma-BHC (Lindane)					<0.020	<0.002	<0.002	<0.020	<0.073	<0.0019	<0.0019	<0.0019	<0.0017	<0.0017J	<0.002J
Heptachlor	0.1	0.2			<0.020	<0.002	<0.002	<0.020	<0.073	<0.0019	<0.0019	<0.0019	<0.0017	<0.0017	<0.002
Aldrin	0.03	0.04			<0.020	<0.002	<0.002	<0.020	<0.073	<0.0019	<0.0019	<0.0019	<0.0017	<0.0017	<0.002
beta-BHC					<0.020	<0.002	<0.002	<0.020	<0.073	<0.0019	<0.0019	<0.0019	<0.0017	<0.0017J	<0.002J
delta-BHC					<0.020	<0.002	<0.002	<0.020	<0.073	<0.0019	<0.0019	<0.0019	<0.0017	<0.0017	<0.002
Heptachlor epoxide	0.06	0.09			<0.020	<0.002	<0.002	<0.020	<0.073	<0.0019	<0.0019	<0.0019	<0.0017	<0.0017J	<0.002J
Endosulfan I	20	0.05			<0.020	<0.002	<0.002	<0.020	<0.073	<0.0019	<0.0019	<0.0019	<0.0017	<0.0017J	<0.002J
gamma-Chlordane	1	2			<0.020	<0.002	<0.002	<0.020	<0.073	<0.0019	<0.0019	<0.0019	<0.0017	<0.0017J	<0.002J
alpha-Chlordane	1	2			<0.020	<0.002	<0.002	<0.020	<0.073	<0.0019	<0.0019	<0.0019	<0.0017	<0.0017J	<0.002J
4,4'-DDE	2	2			<0.040	<0.004	<0.004	<0.040	<0.140	<0.0036	<0.0036	<0.0036	<0.0033	<0.0033	<0.004
Dieldrin	0.03	0.04			0.042J	<0.004	<0.004	<0.040	<0.140	<0.0036	<0.0036	<0.0036	<0.0033	<0.0033J	<0.004J
Endrin	0.6	1			<0.040	<0.004	<0.004	<0.040	<0.140	<0.0036	<0.0036	<0.0036	<0.0033	<0.0033J	<0.004J
4,4'-DDD	2	3			0.2J	<0.004	<0.004	<0.040	1.8J	<0.0036	<0.0036	<0.0036	<0.0033	<0.0033J	<0.004J
Endosulfan II					<0.040	<0.004	<0.004	<0.040	<0.140	<0.0036	<0.0036	<0.0036	<0.0033	<0.0033J	<0.004J
4,4'-DDT	2	2			<0.040	<0.004	<0.004	<0.040	<0.140	<0.0036	<0.0036	<0.0036	<0.0033	<0.0033J	<0.004J
Endrin aldehyde					<0.040	<0.004	<0.004	<0.040	<0.140	<0.0036	<0.0036	<0.0036	<0.0033	<0.0033	<0.004
Endosulfan sulfate					<0.040	<0.004	<0.004	<0.040	<0.140	<0.0036	<0.0036	<0.0036	<0.0033	<0.0033J	<0.004J
Methoxychlor	100	30			<0.200	<0.020	<0.020	<0.200	<0.730	<0.019	<0.019	<0.019	<0.017	R	R
Endrin ketone					<0.040	<0.004	<0.004	<0.040	<0.140	<0.0036	<0.0036	<0.0036	<0.0033	<0.0033	<0.004
Toxaphene					<0.400	<0.040	<0.040	<0.400	<1.400	<0.036	<0.036	<0.036	<0.033	R	R

Notes:
MCP S-2/GW-3 Standards identified as cleanup goals in Action Memorandum
* = standard is for mixed isomers
J = estimated
R = rejected
< = less than
= sample locations removed during subsequent excavation

TABLE 2-9
CONFIRMATORY SAMPLING RESULTS
AOC 57 AREA 3 REMOVAL ACTION
AOC 57

FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MASSACHUSETTS

SAMPLE ID / DATE COLLECTED	MCP S-1/GW-1 (mg/kg)	MCP S-2/GW-3 (mg/kg)	RISK BASED SURFACE (mg/kg)	RISK BASED SUBSURFACE (mg/kg)	ED57W10X 3 ft bgs 16-Apr-99	EX57W11X 4 ft bgs 16-Apr-99	EX57W12X 1 ft bgs 16-Apr-99	EX57W13X 2 ft bgs 16-Apr-99	EX57W14X 2 ft bgs 11-Jun-99	EX57W15X 1 ft bgs 11-Jun-99	ED57W15X 1 ft bgs 11-Jun-99	EX57W16X 2 ft bgs 11-Jun-99	EX57W17X 2 ft bgs 11-Jun-99	EX57F01X 6 ft bgs 25-Mar-99	EX57F02X 8 ft bgs 25-Mar-99	EX57F03X 3 ft bgs 15-Apr-99
VPH (mg/kg)																
n-C5 to n-C8 Aliphatic	100	500			<16	<1200	<22	<18J	<16	<20	<22	<140	<15	<18	<18	<15
n-C9 to n-C12 Aliphatic	1000	2500			<3.9	2500	<5.5	<4.4J	52	<5	<5.4	870	16	<4.6	<4.6	47
n-C9 to n-C10 Aromatic	100	500			<3.9	1900	<5.5	<4.4J	55	<5J	<5.4J	600	<3.7J	<4.6	<4.6	37
Benzene	10	60			<2.0	<140	<2.7	<2.2J	<110	<140J	<160J	<1000	<110J	<2.3	<2.3	<1.9
Ethylbenzene	80	80			<2.0	<140	<2.7	<2.2J	<110	<140J	<160J	<1000	<110J	<2.3	<2.3	<1.9
m,p-Xylene	500*	1000*			<7.9	<580	<11	<8.8J	<7.9	<10J	<11J	<72	<7.4J	<9.3	<9.1	<7.4
MTBE	0.3	200			<5.9	<440	<8.2	<6.6J	<5.9	<7.5	<8.2	<54	<5.6	<7.0	<6.8	<5.6
Naphthalene	4	1000			<3.9	<290	<5.5	<4.4J	<230	<290J	<310J	<2100	<210J	<4.6	<4.6	<3.7
o-Xylene	500*	1000*			<3.9	<290	<5.5	<4.4J	<110	<140J	<160J	<1000	<110J	<4.6	<4.6	<3.7
Toluene	90	1000			<5.9	<440	<8.2	<6.6J	<230	<290J	<310J	<2100	<210J	<7.0	<6.8	<5.6
EPH (mg/kg)																
n-C9 to n-C18 Aliphatic	1000	2500	NA	NA	<7.0	1900	210J	67	920	880	650	1300	<3.6	78	<7.6	<7.5
n-C19 to n-C36 Aliphatic	2500	5000	20000	20000	<7.0	10000	8000J	1500	20000	7700	6700	8600	<4.8	990	<12	<7.5
n-C11 to n-C22 Aromatic	200	2000	5000	10000	<19	2300	930	100J	3100	1300	1100	1400	<19	110	<20	<20
2-Methylnaphthalene	4	1000			<1.8	13	<2.4	<2.1J	<6.4	<2.2	<2.3	<3.9	<1.8	<2.0	<1.9	<1.9
Acenaphthene	20	2000			<1.8	<3.8	<2.4	<2.1J	<6.4	<2.2	<2.3	<3.9	<1.8	<2.0	<1.9	<1.9
Acenaphthylene	100	1000			<1.8	<3.8	<2.4	<2.1J	<6.4	<2.2	<2.3	<3.9	<1.8	<2.0	<1.9	<1.9
Anthracene	1000	2500			<1.8	<3.8	<2.4	<2.1J	<6.4	<2.2	<2.3	<3.9	<1.8	<2.0	<1.9	<1.9
Benzo(a)anthracene	0.7	1			<1.8	<3.8	<2.4	<2.1J	<6.4	<2.2	<2.3	<3.9	<1.8	<2.0	<1.9	<1.9
Benzo(a)pyrene	0.7	0.7			<1.8	<3.8	<2.4	<2.1J	<6.4	<2.2	<2.3	<3.9	<1.8	<2.0	<1.9	<1.9
Benzo(b)fluoranthene	0.7	1			<1.8	<3.8	<2.4	<2.1J	<6.4	<2.2	<2.3	<3.9	<1.8	<2.0	<1.9	<1.9
Benzo(g,h,i)perylene	1000	2500			<1.8	<3.8	<2.4	<2.1J	<6.4	<2.2	<2.3	<3.9	<1.8	<2.0	<1.9	<1.9
Benzo(k)fluoranthene	7	10			<1.8	<3.8	<2.4	<2.1J	<6.4	<2.2	<2.3	<3.9	<1.8	<2.0	<1.9	<1.9
Chrysene	7	10			<1.8	<3.8	<2.4	<2.1J	<6.4	<2.2	<2.3	<3.9	<1.8	<2.0	<1.9	<1.9
Dibenzo(a,h)anthracene	0.7	0.7			<1.8	<3.8	<2.4	<2.1J	<6.4	<2.2	<2.3	<3.9	<1.8	<2.0	<1.9	<1.9
Fluoranthene	1000	600			<1.8	<3.8	<2.4	<2.1J	<6.4	<2.2	<2.3	<3.9	<1.8	<2.0	<1.9	<1.9
Fluorene	400	1000			<1.8	<3.8	<2.4	<2.1J	<6.4	<2.2	<2.3	<3.9	<1.8	<2.0	<1.9	<1.9
Indeno(1,2,3-cd)pyrene	0.7	1			<1.8	<3.8	<2.4	<2.1J	<6.4	<2.2	<2.3	<3.9	<1.8	<2.0	<1.9	<1.9
Naphthalene	4	1000			<1.8	10	<2.4	<2.1J	<6.4	<2.2	<2.3	<3.9	<1.8	<2.0J	<1.9J	<1.9
Phenanthrene	700	100			<1.8	<3.8	<2.4	<2.1J	<6.4	<2.2	<2.3	<3.9	<1.8	<2.0	<1.9	<1.9
Pyrene	700	2000			<1.8	<3.8	<2.4	<2.1J	<6.4	<2.2	<2.3	<3.9	<1.8	<2.0	<1.9	<1.9
PCBs (mg/kg)																
PCB-1016	2	2	2	4	<0.020	<0.200	<0.540	<0.480	<0.240	<0.025	<0.026	<0.022	<0.020	<0.024	<0.022	<0.020
PCB-1221	2	2	2	4	<0.040	<0.400	<1.100	<0.920	<0.470	<0.049	<0.050	<0.043	<0.040	<0.046	<0.043	<0.040
PCB-1232	2	2	2	4	<0.020	<0.200	<0.540	<0.480	<0.240	<0.025	<0.026	<0.022	<0.020	<0.024	<0.022	<0.020
PCB-1242	2	2	2	4	<0.020	2.4	<0.540	<0.480	<0.240	<0.025	<0.026	<0.022	<0.020	<0.024	<0.022	<0.020
PCB-1248	2	2	2	4	<0.020	<0.200	<0.540	4	<0.240	<0.025	<0.026	<0.022	<0.020	<0.024	<0.022	<0.020
PCB-1254	2	2	2	4	<0.020	<0.200	<0.540	<0.480	<0.240	<0.025	<0.026	<0.022	<0.020	<0.024	<0.022	<0.020
PCB-1260	2	2	2	4	<0.020	3.5	14	9.6	4.3	<0.025	<0.026	<0.022	<0.020	2.6	<0.022	0.056
PESTICIDES (mg/kg)																
alpha-BHC					<0.002	<0.020	<0.054	<0.048	<0.024	<0.026	<0.026	<0.022	<0.020	<0.024	<0.0022	<0.002
gamma-BHC (Lindane)					<0.002J	<0.020J	<0.054J	<0.048J	<0.024	<0.026	<0.026	<0.022	<0.020	<0.024	<0.0022	<0.002J
Heptachlor	0.1	0.2			<0.002	0.046	<0.054	<0.048	<0.024	<0.026	<0.026	<0.022	<0.020	<0.024	<0.0022	<0.002
Aldrin	0.03	0.04			<0.002	<0.020	<0.054	<0.048	<0.024	<0.026	<0.026	<0.022	<0.020	<0.024	<0.0022	<0.002
beta-BHC					<0.002J	<0.020J	<0.054J	<0.048J	<0.024	<0.026	<0.026	<0.022	<0.020	<0.024	<0.0022	<0.002J
delta-BHC					<0.002	<0.020	<0.054	<0.048	<0.024	<0.026	<0.026	<0.022	<0.020	<0.024	<0.0022	<0.002
Heptachlor epoxide	0.06	0.09			<0.002J	<0.020J	<0.054J	<0.048J	<0.024	<0.026	<0.026	<0.022	<0.020	<0.024	<0.0022	<0.002J
Endosulfan I	20	0.05			<0.002J	<0.020J	<0.054J	<0.048J	<0.024	<0.026	<0.026	<0.022	<0.020	<0.024	<0.0022	<0.002J
gamma-Chlordane	1	2			<0.002J	<0.020J	<0.054J	<0.048J	<0.024	<0.026	<0.026	<0.022	<0.020	<0.024	<0.0022	<0.002
alpha-Chlordane	1	2			<0.002J	<0.020J	<0.054J	<0.048J	<0.024	<0.026	<0.026	<0.022	<0.020	<0.024	<0.0022	<0.002J
4,4'-DDE	2	2			<0.004	<0.040	0.12	<0.092	<0.046	<0.050	<0.050	<0.043	<0.040	<0.046	<0.0043	<0.004
Dieldrin	0.03	0.04			<0.004J	0.06J	0.26J	0.15J	0.14	<0.050	<0.050	0.086	<0.040	<0.046	<0.0043	<0.004J
Endrin	0.6	1			<0.004J	<0.040J	<0.110J	<0.092J	0.054	<0.050	<0.050	0.07	<0.040	<0.046	<0.0043	<0.004J
4,4'-DDD	2	3			<0.004J	<0.040J	<0.110J	<0.092J	<0.046	0.27	0.24	0.29	<0.040	0.24	<0.0043	<0.004J
Endosulfan II					<0.004J	<0.040J	<0.110J	<0.092J	<0.046	<0.050	<0.050	<0.043	<0.040	<0.046	<0.0043	<0.004J
4,4'-DDT	2	2			<0.004J	<0.040J	1.1J	<0.092J	<0.046	<0.050	<0.050	<0.043	<0.040	<0.046	<0.0043	<0.004J
Endrin aldehyde					<0.004	<0.040	<0.110	<0.092	<0.046	<0.050	<0.050	<0.043	<0.040	<0.046	<0.0043	<0.004
Endosulfan sulfate					<0.004J	<0.040J	<0.110J	<0.092J	<0.046	<0.050	<0.050	<0.043	<0.040	<0.046	<0.0043	<0.004J
Methoxychlor	100	30			R	R	R	R	<0.240	<0.260	<0.260	<0.220	<0.200	<0.24	<0.022	R
Endrin ketone					<0.004	<0.040	<0.110	<0.092	<0.046	<0.050	<0.050	<0.043	<0.040	<0.046	<0.0043	<0.004
Toxaphene					R	R	R	R	<0.460	<0.500	<0.500	<0.430	<0.400	<.46	<0.043	R

Notes:
MCP S-2/GW-3 Standards identified as cleanup goals in Action Memorandum
* = standard is for mixed isomers
J = estimated
R = rejected
< = less than
[shaded] = sample locations removed during subsequent excava

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TABLE 2-10
2000 VERTICAL GROUNDWATER SCREENING - AREA 3
FIELD ANALYTICAL RESULTS
AOC 57

FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MASSACHUSETTS

Sample Location	Sample ID	Depth (ft bgs)	PCE µg/L	TCE µg/L	DCE (cis and trans) µg/L	1,2-DCB µg/L	1,3-DCB µg/L	1,4-DCB µg/L	NOTES
57N-00-01X	57N-00-011	3-8	<1	<1	<1	<1	<1	<1	Possible fuel fingerprint
	57N-00-012	13-18	<1	<1	<1	<1	<1	<1	
	57N-00-013	23-28	<1	<1	<1	<1	<1	<1	
	57N-00-014	33-38	<1	<1	<1	<1	<1	<1	
	57N-00-015	43-48	<1	<1	<1	<1	<1	<1	
	57N-00-016	53-58	<1	<1	<1	<1	<1	<1	
57N-00-02X	57N-00-021	14-19	<1	<1	<1	<1	<1	<1	
	57N-00-022	24-29	<1	<1	<1	<1	<1	<1	
	57N-00-023	34-39	**1**	<1	<1	<1	<1	<1	
	57N-00-024	44-49	<1	<1	<1	<1	<1	<1	
	57N-00-025	54-59	<1	**12.4**	<1	<1	<1	<1	
	57N-00-026	64-69	<1	<1	<1	<1	<1	<1	
	57N-00-027	74-79	<1	<1	<1	<1	<1	<1	

Note:
57N-00-01X is downgradient location
57N-00-02X is upgradient location
ug/l = micrograms/liter
ft bgs = feet below ground surface

TABLE 2-11
2000 VERTICAL GROUNDWATER SCREENING - AREA 3
SPLIT-SAMPLE OFF-SITE ANALYTICAL RESULTS
AOC 57

FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MASSACHUSETTS

	Sample Location Sample ID MADEP Sample ID Depth (feet bgs)	57N-00-01X 57N-00-011 AOC 57-00-X1 3-8	57N-00-01X 57N-00-012 AOC 57-00-X2 13-18	57N-00-01X 57N-00-013 AOC 57-00-X3 23-28	57N-00-01X 57N-00-014 AOC 57-00-X4 33-38	57N-00-01X 57N-00-015 AOC 57-00-X5 43-48
Analyte	**Reporting Limit (ug/L)**					
Acetone	50	**111**	<11	<11	<11	<11
Methylene Chloride	2	<0.49	**4.9**	**2**	**3.9**	**23**
Methyl Ethyl Ketone	20	**210**	<4	<4	<4	<4
Trichloroethene	2	<0.45	<0.45	<0.45	<0.45	<0.45
Toluene	2	**2.1**	**1.3**	<0.22	<0.22	<0.22
Tetrachloroethene	2	<0.34	**4.8**	**0.88**	<0.34	<0.34
Chlorobenzene	2	**3.7**	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	2	**1.9**	<0.43	<0.43	<0.43	<0.43
m,p-Xylene	2	**2.1**	<0.38	<0.38	<0.38	<0.38
o-Xylene	2	**2.9**	**1.4**	<0.42	<0.42	<0.42
n-Propylbenzene	2	**1.6**	<0.36	<0.36	<0.36	<0.36
1,3,5-Trimethylbenzene	2	**21**	**2.6**	<0.3	<0.3	<0.3
1,2,4-Trimethylbenzen	2	**29**	**1.9**	<0.42	<0.42	<0.42
1,4-Dichlorobenzene	2	**1.9**	**1.1**	<0.48	<0.48	<0.48
1,2-Dichlorobenzene	2	**3.4**	**3.2**	<0.23	<0.23	<0.23
Naphthalene	2	**2.1**	<0.06	<0.06	<0.06	<0.06

Note:
57N-00-01X is downgradient location
57N-00-02X is upgradient location
ug/l = micrograms/liter
ft bgs = feet below ground surface

TABLE 2-11
2000 VERTICAL GROUNDWATER SCREENING - AREA 3
SPLIT-SAMPLE OFF-SITE ANALYTICAL RESULTS
AOC 57

FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MASSACHUSETTS

	Sample Location	57N-00-01X	57N-00-02X	57N-00-02X	57N-00-02X	57N-00-02X
	Sample ID	57N-00-016	57N-00-021	57N-00-025	57N-00-026	57N-00-027
	MADEP Sample ID	AOC 57-00-X6	AOC 57-00-01	AOC 57-00-05	AOC 57-00-06	AOC 57-00-07
	Depth (feet bgs)	53-58	14-19	54-59	64-69	74-79
Analyte	**Reporting Limit (ug/L)**					
Acetone	50	<11	<11	<11	<11	<11
Methylene Chloride	2	**41**	<0.49	**3.8**	**36**	**13**
Methyl Ethyl Ketone	20	<4	<4	<4	<4	<4
Trichloroethene	2	<0.45	<0.45	**17**	<0.45	**1.4**
Toluene	2	<0.22	<0.22	<0.22	<0.22	<0.22
Tetrachloroethene	2	<0.34	<0.34	**1**	<0.34	<0.34
Chlorobenzene	2	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	2	<0.43	<0.43	<0.43	<0.43	<0.43
m,p-Xylene	2	<0.38	<0.38	<0.38	<0.38	<0.38
o-Xylene	2	<0.42	<0.42	<0.42	<0.42	<0.42
n-Propylbenzene	2	<0.36	<0.36	<0.36	<0.36	<0.36
1,3,5-Trimethylbenzene	2	<0.3	<0.3	<0.3	<0.3	<0.3
1,2,4-Trimethylbenzen	2	<0.42	<0.42	<0.42	<0.42	<0.42
1,4-Dichlorobenzene	2	<0.48	<0.48	<0.48	<0.48	<0.48
1,2-Dichlorobenzene	2	<0.23	<0.23	<0.23	<0.23	<0.23
Naphthalene	2	<0.06	<0.06	<0.06	<0.06	<0.06

Note:
57N-00-01X is downgradient location
57N-00-02X is upgradient location
ug/l = micrograms/liter
ft bgs = feet below ground surface

TABLE 2-12
QUANTITATIVE HUMAN HEALTH RISK SUMMARY
AOC 57

FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MASSACHUSETTS

	CENTRAL TENDENCY Total Cancer Risk	CENTRAL TENDENCY Total Hazard Index	RME Total Cancer Risk	RME Total Hazard Index
AREA 2 INDUSTRIAL				
CURRENT LAND USE				
Maintenance Worker - Surface Soil				
Incidental Ingestion of Surface Soil: Maintenance Worker	2E-07	0.007	2E-06	0.03
Dermal Contact with Surface Soil: Maintenance Worker	8E-09	0.001	6E-08	0.002
Inhalation of Particulates from Surface Soil: Maintenance Worker	3E-10	0.0002	2E-09	0.0007
Receptor Total: Maintenance Worker	**2E-07**	**0.008**	**2E-06**	**0.03**
POSSIBLE FUTURE LAND USE				
Commercial/Industrial Worker - Surface Soil				
Incidental Ingestion of Surface Soil: Commercial/Industrial Worker	9E-07	0.04	7E-06	0.08
Dermal Contact with Surface Soil: Commercial/Industrial Worker	5E-08	0.01	2E-07	0.01
Inhalation of Particulates from Surface Soil: Commercial/Industrial Worker	2E-09	0.002	6E-09	0.002
Total	**1E-06**	**0.05**	**7E-06**	**0.09**
Commercial/Industrial Worker - Groundwater				
Ingestion of Groundwater: Commercial/Industrial Worker	NE	0.07	NE	0.07
Total	**NE**	**0.07**	**NE**	**0.07**
Receptor Total: Commercial/Industrial Worker	**1E-06**	**0.1**	**7E-06**	**0.2**
Construction Worker - Surface Soil				
Incidental Ingestion of Surface Soil: Construction Worker	5E-07	0.4	1E-06	0.4
Dermal Contact with Surface Soil: Construction Worker	5E-08	0.05	1E-07	0.05
Inhalation of Particulates from Surface Soil: Construction Worker	2E-10	0.007	4E-10	0.007
Total	**6E-07**	**0.5**	**1E-06**	**0.5**
Construction Worker - Subsurface Soil				
Incidental Ingestion of Subsurface Soil: Construction Worker	2E-07	0.2	5E-07	0.2
Dermal Contact with Subsurface Soil: Construction Worker	2E-08	0.01	5E-08	0.01
Inhalation of Particulates from Subsurface Soil: Construction Worker	1E-10	0.003	2E-10	0.003
Total	**2E-07**	**0.2**	**6E-07**	**0.2**
Receptor Total: Construction Worker	**8.E-07**	**0.6**	**2.E-06**	**0.7**
UNRESTRICTED LAND USE				
Adult Resident - Surface Soil				
Incidental Ingestion of Surface Soil: Adult Resident			6E-06	0.09
Dermal Contact with Surface Soil: Adult Resident			9E-07	0.04
Inhalation of Particulates from Surface Soil: Adult Resident			2E-09	0.001
Total	**Not Evaluated***		**7E-06**	**0.1**
Adult Resident - Subsurface Soil				
Incidental Ingestion of Subsurface Soil: Adult Resident			3E-06	0.02
Dermal Contact with Subsurface Soil: Adult Resident			4E-07	0.003
Inhalation of Particulates from Subsurface Soil: Adult Resident			1E-09	0.0004
Total	**Not Evaluated***		**3E-06**	**0.02**
Adult Resident Total: Soil			**1.E-05**	**0.2**
Child Resident - Surface Soil				
Incidental Ingestion of Surface Soil: Child Resident			1E-05	0.8
Dermal Contact with Surface Soil: Child Resident			5E-06	0.8
Inhalation of Particulates from Surface Soil: Child Resident			6E-09	0.002
Total	**Not Evaluated***		**2E-05**	**2** [b]
Child Resident - Subsurface Soil				
Incidental Ingestion of Subsurface Soil: Child Resident			7E-06	0.2
Dermal Contact with Subsurface Soil: Child Resident			2E-06	0.1
Inhalation of Particulates from Subsurface Soil: Child Resident			7E-10	0.001
Total	**Not Evaluated***		**9E-06**	**0.3**
Child Resident Total: Soil			**2.E-05**	**2**
Adult Resident - Groundwater				
Ingestion of Groundwater: Adult Resident			NE	0.2
Total	**Not Evaluated***		**NE**	**0.2**
Receptor Total: Resident [a]			**3.E-05**	**0.4**

TABLE 2-12
QUANTITATIVE HUMAN HEALTH RISK SUMMARY
AOC 57

FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MASSACHUSETTS

	CENTRAL TENDENCY		RME	
	Total Cancer Risk	Total Hazard Index	Total Cancer Risk	Total Hazard Index
AREA 2 - RECREATIONAL				
CURRENT LAND USE				
Recreational Child - Surface Soil				
Incidental Ingestion of Surface Soil: Recreational Child	1E-06	0.04	5E-06	0.1
Dermal Contact with Surface Soil: Recreational Child	4E-06	0.3	8E-06	0.6
Total	**5E-06**	**0.3**	**1E-05**	**0.7**
Recreational Child - Sediment				
Incidental Ingestion of Sediment: Recreational Child	2E-06	0.04	5E-06	0.1
Dermal Contact with Sediment: Recreational Child	1E-05	0.3	2E-05	0.6
Total	**1E-05**	**0.3**	**3E-05**	**0.7**
Recreational Child - Surface Water				
Incidental Ingestion of Surface Water: Recreational Child	2E-06	0.04	5E-06	0.09
Dermal Contact with Surface Water: Recreational Child	5E-07	0.03	9E-07	0.06
Total	**3E-06**	**0.07**	**6E-06**	**0.1**
Receptor Total: Recreational Child	**2E-05**	**0.7**	**5E-05**	**1**
POSSIBLE FUTURE LAND USE				
Construction Worker - Surface Soil				
Incidental Ingestion of Surface Soil: Construction Worker	1E-06	1	3E-06	1
Dermal Contact with Surface Soil: Construction Worker	2E-07	0.3	4E-07	0.3
Inhalation of Particulates from Surface Soil: Construction Worker	5E-10	0.004	1E-09	0.004
Total	**1E-06**	**1**	**3E-06**	**1**
Construction Worker - Subsurface Soil				
Incidental Ingestion of Subsurface Soil: Construction Worker	1E-06	2	2E-06	2
Dermal Contact with Subsurface Soil: Construction Worker	1E-07	0.3	1E-07	0.7
Inhalation of Particulates from Subsurface Soil: Construction Worker	7E-08	0.02	1E-07	0.02
Total	**1E-06**	**3**	**2E-06**	**3**
Receptor Total: Construction Worker	**2.E-06**	**4**	**6.E-06**	**4**
UNRESTRICTED LAND USE				
Adult Resident - Surface Soil				
Incidental Ingestion of Surface Soil: Adult Resident			2E-05	0.2
Dermal Contact with Surface Soil: Adult Resident			3E-06	0.1
Inhalation of Particulates from Surface Soil: Adult Resident			6E-09	0.0004
Total	**Not Evaluated***		**2E-05**	**0.3**
Adult Resident - Subsurface Soil				
Incidental Ingestion of Subsurface Soil: Adult Resident			1E-05	1
Dermal Contact with Subsurface Soil: Adult Resident			5E-06	0.4
Inhalation of Particulates from Subsurface Soil: Adult Resident			8E-07	0.002
Total	**Not Evaluated***		**2E-05**	**1**
Adult Resident Total: Soil			**4.E-05**	**2**
Child Resident - Surface Soil				
Incidental Ingestion of Surface Soil: Child Resident			4E-05	2
Dermal Contact with Surface Soil: Child Resident			2E-05	2
Inhalation of Particulates from Surface Soil: Child Resident			3E-09	0.001
Total	**Not Evaluated***		**6E-05**	**4**
Child Resident - Subsurface Soil				
Incidental Ingestion of Subsurface Soil: Child Resident			3E-05	10
Dermal Contact with Subsurface Soil: Child Resident			3E-05	9
Inhalation of Particulates from Subsurface Soil: Child Resident			4E-07	0.005
Total	**Not Evaluated***		**6E-05**	**19**
Child Resident Total: Soil			**1.E-04**	**23**
Adult Resident - Groundwater				
Ingestion of Groundwater: Adult Resident			1.E-03	7
Total	**Not Evaluated***		**1E-03**	**7**
Receptor Total: Resident [a]			**1.E-03**	**9**

TABLE 2-12
QUANTITATIVE HUMAN HEALTH RISK SUMMARY
AOC 57

FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MASSACHUSETTS

	CENTRAL TENDENCY		RME	
	Total Cancer Risk	Total Hazard Index	Total Cancer Risk	Total Hazard Index
AREA 3 - INDUSTRIAL				
CURRENT LAND USE				
Maintenance Worker - Surface Soil				
Incidental Ingestion of Surface Soil: Maintenance Worker	3E-07	0.007	4E-06	0.03
Dermal Contact with Surface Soil: Maintenance Worker	2E-08	0.001	1E-07	0.001
Inhalation of Particulates from Surface Soil: Maintenance Worker	6E-10	0.0004	4E-09	0.0008
Receptor Total: Maintenance Worker	**3E-07**	**0.008**	**4E-06**	**0.03**
POSSIBLE FUTURE LAND USE				
Commercial/Industrial Worker - Surface Soil				
Incidental Ingestion of Surface Soil: Commercial/Industrial Worker	2E-06	0.04	1E-05	0.09
Dermal Contact with Surface Soil: Commercial/Industrial Worker	9E-08	0.002	3E-07	0.002
Inhalation of Particulates from Surface Soil: Commercial/Industrial Worker	3E-09	0.002	1E-08	0.002
Total	**2E-06**	**0.04**	**1E-05**	**0.09**
Commercial/Industrial Worker - Groundwater				
Ingestion of Groundwater: Commercial/Industrial Worker	5E-05	2	2E-04	2
Total	**5E-05**	**2**	**2E-04**	**2**
Receptor Total: Commercial/Industrial Worker	**5E-05**	**2**	**2E-04**	**2**
Construction Worker - Surface Soil				
Incidental Ingestion of Surface Soil: Construction Worker	1E-06	0.7	2E-06	0.7
Dermal Contact with Surface Soil: Construction Worker	1E-07	0.06	2E-07	0.06
Inhalation of Particulates from Surface Soil: Construction Worker	4E-10	0.008	9E-10	0.008
Total	**1E-06**	**0.8**	**2E-06**	**0.8**
Construction Worker - Subsurface Soil				
Incidental Ingestion of Subsurface Soil: Construction Worker	2E-07	0.2	5E-07	0.2
Dermal Contact with Subsurface Soil: Construction Worker	2E-08	0.02	5E-08	0.02
Inhalation of Particulates from Subsurface Soil: Construction Worker	1E-10	0.0000001	2E-10	0.0000001
Total	**3E-07**	**0.2**	**6E-07**	**0.2**
Receptor Total: Construction Worker	**1.E-06**	**1**	**3.E-06**	**1**
UNRESTRICTED LAND USE				
Adult Resident - Surface Soil				
Incidental Ingestion of Surface Soil: Adult Resident			1E-05	0.09
Dermal Contact with Surface Soil: Adult Resident			2E-06	0.01
Inhalation of Particulates from Surface Soil: Adult Resident			5E-09	0.001
Total	**Not Evaluated***		**1E-05**	**0.1**
Adult Resident - Subsurface Soil				
Incidental Ingestion of Subsurface Soil: Adult Resident			3E-06	0.02
Dermal Contact with Subsurface Soil: Adult Resident			4E-07	0.005
Inhalation of Particulates from Subsurface Soil: Adult Resident			1E-09	0.0000001
Total	**Not Evaluated***		**3E-06**	**0.03**
Adult Resident Total: Soil			**2.E-05**	**0.1**
Child Resident - Surface Soil				
Incidental Ingestion of Surface Soil: Child Resident			3E-05	0.8
Dermal Contact with Surface Soil: Child Resident			9E-06	0.2
Inhalation of Particulates from Surface Soil: Child Resident			3E-09	0.002
Total	**Not Evaluated***		**4E-05**	**1**
Child Resident - Subsurface Soil				
Incidental Ingestion of Subsurface Soil: Child Resident			7E-06	0.2
Dermal Contact with Subsurface Soil: Child Resident			2E-06	0.1
Inhalation of Particulates from Subsurface Soil: Child Resident			6E-10	0.0000003
Total	**Not Evaluated***		**9E-06**	**0.3**
Child Resident Total: Soil			**5.E-05**	**1**
Adult Resident - Groundwater				
Ingestion of Groundwater: Adult Resident			6.E-04	5
Total	**Not Evaluated***		**6E-04**	**5**
Receptor Total: Resident [a]			**7.E-04**	**5**

TABLE 2-12
QUANTITATIVE HUMAN HEALTH RISK SUMMARY
AOC 57

FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MASSACHUSETTS

	CENTRAL TENDENCY		RME	
	Total Cancer Risk	Total Hazard Index	Total Cancer Risk	Total Hazard Index
AREA 3 - RECREATIONAL				
CURRENT LAND USE				
Recreational Child - Surface Soil				
Incidental Ingestion of Surface Soil: Recreational Child	6E-07	0.02	3E-06	0.09
Dermal Contact with Surface Soil: Recreational Child	2E-06	0.2	3E-06	0.4
Total	**3E-06**	**0.2**	**6E-06**	**0.5**
Recreational Child - Sediment				
Incidental Ingestion of Sediment: Recreational Child	4E-07	0.003	8E-07	0.01
Dermal Contact with Sediment: Recreational Child	2E-06	0.07	5E-06	0.1
Total	**2E-06**	**0.07**	**6E-06**	**0.1**
Recreational Child - Surface Water				
Incidental Ingestion of Surface Water: Recreational Child	2E-06	0.05	4E-06	0.1
Dermal Contact with Surface Water: Recreational Child	5E-07	0.01	1E-06	0.01
Total	**3E-06**	**0.06**	**5E-06**	**0.1**
Receptor Total: Recreational Child	**9E-06**	**0.3**	**2E-05**	**0.7**
POSSIBLE FUTURE LAND USE				
Construction Worker - Surface Soil				
Incidental Ingestion of Surface Soil: Construction Worker	4E-06	0.5	9E-06	0.5
Dermal Contact with Surface Soil: Construction Worker	7E-08	0.08	1E-07	0.08
Inhalation of Particulates from Surface Soil: Construction Worker	3E-10	0.002	6E-10	0.002
Total	**4E-06**	**0.6**	**9E-06**	**0.6**
Construction Worker - Subsurface Soil				
Incidental Ingestion of Subsurface Soil: Construction Worker	7E-07	0.4	1E-06	0.4
Dermal Contact with Subsurface Soil: Construction Worker	7E-08	0.04	1E-07	0.04
Inhalation of Particulates from Subsurface Soil: Construction Worker	3E-10	--	6E-10	--
Total	**8E-07**	**0.4**	**1E-06**	**0.4**
Receptor Total: Construction Worker	**5.E-06**	**1**	**1.E-05**	**1**
UNRESTRICTED LAND USE				
Adult Resident - Surface Soil				
Incidental Ingestion of Surface Soil: Adult Resident			9E-06	0.1
Dermal Contact with Surface Soil: Adult Resident			1E-06	0.08
Inhalation of Particulates from Surface Soil: Adult Resident			3E-09	0.0003
Total	**Not Evaluated***		**1E-05**	**0.2**
Adult Resident - Subsurface Soil				
Incidental Ingestion of Subsurface Soil: Adult Resident			9E-06	0.1
Dermal Contact with Subsurface Soil: Adult Resident			1E-06	0.01
Inhalation of Particulates from Subsurface Soil: Adult Resident			3E-09	--
Total	**Not Evaluated***		**1E-05**	**0.1**
Adult Resident Total: Soil			**2.E-05**	**0.3**
Child Resident - Surface Soil				
Incidental Ingestion of Surface Soil: Child Resident			2E-05	1
Dermal Contact with Surface Soil: Child Resident			7E-06	2
Inhalation of Particulates from Surface Soil: Child Resident			2E-09	0.0006
Total	**Not Evaluated***		**3E-05**	**3**
Child Resident - Subsurface Soil				
Incidental Ingestion of Subsurface Soil: Child Resident			2E-05	0.5
Dermal Contact with Subsurface Soil: Child Resident			7E-06	0.2
Inhalation of Particulates from Subsurface Soil: Child Resident			2E-09	--
Total	**Not Evaluated***		**3E-05**	**0.7**
Child Resident Total: Soil			**5.E-05**	**4**
Adult Resident - Groundwater				
Ingestion of Groundwater: Adult Resident			1.E-03	8
Total	**Not Evaluated***		**1E-03**	**8**
Receptor Total: Resident [a]			**1.E-03**	**8**

TABLE 2-12
QUANTITATIVE HUMAN HEALTH RISK SUMMARY
AOC 57

FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MASSACHUSETTS

	CENTRAL TENDENCY		RME	
	Total Cancer Risk	Total Hazard Index	Total Cancer Risk	Total Hazard Index

NOTES:

[a] Cancer risk is the cumulative receptor cancer risk for child and adult contact with soil and adult ingestion of drinking water. Non-cancer risk is the cumulative adult non-cancer risk for contact with soil and ingestion of drinking water.

[b] Although the total screening HI for the Areas 2, Industrial, Child Resident exposure scenario to surface soil equals 2, target-organ specific HIs are less than or equal to the USEPA target threshold value of 1 for noncancer risks, as documented in the AOC 57 Final RI (see Appendix N-6):

Total Skin HI: 0.7
Total GI HI: 0.05
Total Nervous System HI: 0.07
Total Liver HI: 0.02
Total Kidney HI: 1

RME = Reasonable Maximum Exposure

NE = Not evaluated because there were no carcinogenic CPCs.

NA = Not additive

Totals may not appear accurate due to rounding; but, in fact, are based on addition of individual cancer risks and hazard indices prior to rounding.

* Central tendency not evaluated because only RME risks are assessed for residential exposures.

-- Hazard Index not calculated because there was no inhalation RfD available for the CPCs.

TABLE 3-1
SUMMARY OF NONCANCER RISK ESTIMATES[a]
AOC 57
FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MASSACHUSETTS

Area	Land Use	Medium	Hazard Index		Major Risk Contributor [c]	Risk Contribution [d] (By Chemical)
			Central Tendancy	RME[b]		
Area 2- Recreational (Wetland)	Possible Future (Construction Worker)	Subsurface Soil	3	3	Aroclor-1260	1.7 (immune system)
	Unrestricted (Residential)	Surface	NA(e)	5	Arsenic Aroclor-1260	1.2 (skin) 2.8 (immune system)
		Subsurface	NA(e)	19	Chromium Aroclor-1260 C11-C22	4.4 (NOAEL [GI])[f] 9.2 (immune system) 3.8 (kidney)
		Groundwater	NA(e)	7	Arsenic	5 (skin)
Area 3 - Industrial (Upland)	Possible Future (Commercial/Industrial)	Groundwater	2	2	Arsenic	1.1 (skin)
	Unrestricted (Residential)	Groundwater	NA(e)	5	Arsenic	3.0 (skin)
Area 3 - Recreational (Wetland)	Unrestricted (Residential)	Groundwater	NA(e)	8	Arsenic	7.7 (skin)
		Surface Soil	NA(e)	3	C11-C22	1.7 (kidney)

Note:

(a) Risk exposure scenarios presented in this table are those that present a target-organ specific hazard index greater than 1 based on RME assumptions.

(b) RME = Reasonable maximum exposure

(c) Chemicals that present a hazard quotient greater than 1.

(d) Hazard quotients for individual chemicals at RME. Toxicity endpoint of dose/response value also shown in parentheses.

(e) NA = Not applicable - Only RME risks are assessed for residential exposures

(f) Reference dose (RfD) is based on no observed adverse effects level (NOAEL) dose. However, higher doses in study used to develop RfD were associated with effects on the GI system. Therefore, the HQ for this chemical was included in the segregated HI for effects to the GI system to provide a conservative estimate of the HI.

TABLE 3-2
SUMMARY OF CANCER RISK ESTIMATES[(a)]
AOC 57
FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MASSACHUSETTS

Area	Land Use	Medium	Cumulative Risk		Major Risk Contributor [(c)]	Risk Contribution [(d)] (By Chemical)
			Central Tendency	RME[(b)]		
Area 2- Recreational (Wetland)	Unrestricted (Residential)	Groundwater	NA(e)	1.0E-03	Arsenic Bis(2-ethylhexyl)phthalate Tetrachloroethylene Aroclor -1260	9.6E-04 (92.2 %) 6.6E-05 (6.3%) 9.8E-06 (0.9 %) 5.2E-06 (0.5 %)
Area 3 - Industrial (Upland)	Possible Future (Commercial/Industrial)	Groundwater	4.7E-05	1.7E-04	Arsenic Carbon tetrachloride	1.7E-04 (98.2%) 2.0E-06 (1.2%)
	Unrestricted (Residential)	Groundwater	NA(e)	5.9E-04	Arsenic Carbon tetrachloride 1,4-dichlorobenzene Tetrachloroethylene	5.8E-04 (98.2 %) 6.9E-06 (1.2%) 1.6E-06 (0.3%) 1.6E-06 (0.3%)
Area 3 - Recreational (Wetland)	Unrestricted (Residential)	Groundwater	NA(e)	1.5E-03	Arsenic Bis(2-ethylhexyl)phthalate Tetrachloroethylene	1.5E-03 (99 %) 8.5E-06 (0.6%) 3.4E-06 (0.2%)

Note:

(a) Risk exposure scenarios presented in this table are those that present a cumulative cancer risk greater than 1×10^{-4} based on RME assumptions.

(b) RME = Reasonable maximum exposure

(c) Chemicals that present a cancer risk greater than 1×10^{-6}.

(d) Cancer risks for individual chemicals at RME. Percent contribution to the total risk is shown in parentheses.

(e) NA = Not applicable - Only RME risks are assessed for residential exposures

TABLE 3-3

PROPOSED PRELIMINARY REMEDIATION GOALS FOR SOILS AOC 57

FOCUSED FEASIBILITY STUDY REPORT DEVENS MASSACHUSETTS

LAND USE SCENARIO	AREA	COC (a)	MAXIMUM DETECTION (mg/kg)	BKGRND (b) (mg/kg)	HUMAN HEALTH RBC (c) (mg/kg)	MCP(d) Method 1 S-1/GW-1 (mg/kg)	MCP(d) Method 1 S-2/GW-1 (mg/kg)	PRG (mg/kg)
Possible Future (Construction Worker)	Area 2 Wetland - Subsurface Soil	Aroclor-1260	12	ND	3.5	(f)	(f)	3.5
		Lead	5060	48	400 (e)	300	600	600 (g)
Unrestricted (Residential)	Area 2 Wetland - Surface Soil	Aroclor-1260	4.2	ND	0.5	(f)	(f)	0.5
		Arsenic	61.2	19	21	(f)	(f)	21
	Area 2 Wetland - Subsurface Soil	Chromium	2410	33	550	(f)	(f)	550
		Aroclor-1260	12	ND	0.5	(f)	(f)	0.5
		C11-C22	990 (h)	ND	930	(f)	(f)	930
		Lead	5060	48	400 (e)	(f)	(f)	400
	Area 3 Wetland - Surface Soil	C11-C22	3100	ND	930	(f)	(f)	930

Note:

(a) CPCs that present cancer risks above 1E-06 or target-organ specific HI above 1.0 based on the baseline risk assessment (HLA, 1999a).

(b) Background concentrations for inorganic analytes based upon chemical data gathered from 20 soils samples collected as part of Group 1A and 1B investigations. (See Appendix L of the RI Report (HLA, 1999a)

(c) PRGs are based on receptor risks to soil. Achieving the PRGs listed in this table should enable the residual receptor risks to be at or below a target-organ specific HI of 1 for soil and a cummulative receptor cancer risk at or below 1E-04 for soil.

(d) Massachusetts Contingency Plan Method 1 Risk Characterization S-1/GW-1 and S-2/GW-1 Soil Standards (MADEP, 1997)

(e) USEPA residential soil lead screening level per OSWER Directive 9355.4-12 (USEPA, 1994)

(f) Risk characterization performed following USEPA guidance. Method 1 MCP methods are not applied.

(g) No USEPA commercial/industrial soil lead screening level currently exists. PRG is based upon MCP Method 1 S-2/GW-1 standards (potentially accessible soil, children present, low frequency, and high intensity for construction worker.)

(h) Maximum C11-C22 aromatic concentration was 990 mg/kg. Maximum TPHC concentration was 31,800 mg/kg or an estimated 7,050 mg/kg C11-C-2 converting TPHC concentrations to EPH/VPH concentrations. The computed site-specific average composition of petroleum detected at the site is presented in Appendix N of the RI Report (HLA, 1999a).

(i) Exceedance above 930 mg/kg C11-C12 or the equivalent calculated value 4,195 mg/kg TPHC for Area 2.

ACRONYMS

BKGRND - Background
COC - Contaminant of Concer
CPCs- Contaminants of Potential Concern
MCP - Massachusetts Contingency Plan
ND - Not determined
PRG - Preliminary Remediation Goal
RBC - Risk-Based Concentration

TABLE 3-4

PROPOSED PRELIMINARY REMEDIATION GOALS FOR GROUNDWATER AOC 57 FOCUSED FEASIBILITY STUDY REPORT DEVENS MASSACHUSETTS

LAND USE SCENARIO	AREA	COC (a)	MAXIMUM DETECTION (b) (µg/L)	BKGRND (c) (µg/L)	HUMAN HEALTH RBC (d) (µg/L)	ARARs		PRG (µg/L)
						MCL (e) (µg/L)	MMCL (f) (µg/L)	
Possible Future (Commercial/Ind. Worker)	Area 3 Upland Area	Arsenic	74	10.5	ND	50	50	50
		Carbon Tetrachloride	4.5	ND	ND	5	5	--(g)
		Cadmium	8.67	4.01	ND	5	5	5
		1,4-dichlorobenzene	5.6	ND	ND	75	5	5
Unrestricted (Residential)	Area 2 Wetland Area	Arsenic	54.4	10.5	ND	50	50	50
		BEHP	400	ND	ND	6	6	--(h)
		Tetrachloroethylene	16	ND	ND	5	5	5
		Aroclor -1260	0.22	ND	ND	0.5	0.5	--(g)
	Area 3 Upland Area	Arsenic	74	10.5	ND	50	50	50
		Carbon tetrachloride	4.5	ND	ND	5	5	--(g)
		Cadmium	8.67	4.01	ND	5	5	5
		1,4-dichlorobenzene	5.6	ND	ND	75	5	5
		Tetrachloroethylene	2.6	ND	ND	5	5	--(g)
	Area 3 Wetland Area	Arsenic	84.4	10.5	ND	50	50	50
		BEHP	52	ND	ND	6	6	--(h)
		Tetrachloroethylene	5.5	ND	ND	5	5	5

Note:

(a) CPCs that present cancer risks above 1E-06 or HQs above 1.0 as identified by the baseline risk assessment in the RI Report (HLA, 1999a) or exceedance of an ARAR.

(b) All reported maximum concentrations are for unfiltered samples. Concentrations are for 1995, 1996 and 1998 analytical data.

(c) Background concentrations for inorganic analytes based upon chemical data gathered as part of Group 1A and 1B investigations. (See Appendix L of the RI Report (HLA, 1999a)

(d) RBCs are based on receptor risks to soil. These values were not computed unless no ARAR was available for the COC.

(e) MCL - Maximum Contaminant Levels - USEPA Drinking Water Regulations and Health Advisories (USEPA, 1996)

(f) MMCL - Massachusetts Maximum Contaminant Level - Massachusetts Drinking Water Standards and Guidelines for Chemicals in Massachusetts Drinking Waters. (MADEP/ORS, 1999)

(g) Maximum concentration detected in the area did not exceed MCLs/MMCLs.

(h) Identified as a lab/sampling contaminant.

ACRONYMS:

BEHP - Bis(2-ethylhexyl)phthalate

BKGRND - Background

COC - Contaminant of Concern

CPCs- Contaminants of Potential Concern

ND - Not determined

PRG - Preliminary Remediation Goal

RBC - Risk-Based Concentration

Table 4-1
Screening of Soil Technologies and Process Options

AOC 57
Focused Feasibility Study Report
Devens, Massachusetts

General Response Action/ Technology	Applicability to: Site-Limiting Characteristics	Applicability to: Waste-Limiting Characteristics	Screening Status	Comments
<u>No Action</u> None	None	Does not reduce toxicity, mobility, or volume of contaminants in soil.	Retained.	Required for consideration by NCP. Does not meet remedial response objectives.
<u>Limited Action</u> Deed Restrictions, Zoning Restrictions, Fencing	No or little impact to wetland areas. Deed/zoning restrictions readily enforceable considering planned uses (open space, commercial industrial)	Does not reduce toxicity, mobility, or volume of contaminants in soil but relies on preventing exposure by limiting access and activities.	Retained.	Readily implementable. Any fencing installed to prevent trespassers would have to be maintained.
<u>Containment</u> Cover	A cover would adversely impact wetland areas and future use of the site. Some of the contaminated soil is submerged within the wetland.	Does not reduce toxicity, mobility, or volume of contaminants in soil but relies on preventing exposure by limiting access and activities.	Eliminated.	Physical containment is not possible using conventional methods because some of the contaminated soil area is completely submerged.
<u>Removal</u> Excavation	Access to soils in some areas will infringe upon wetland areas likely requiring wetland restoration. Dewatering may be necessary.	Effectively removes human health risk exposure.	Retained.	Removal actions have been successfully used at both Areas 2 and 3. Wetlands restoration likely needed after excavation activities.
<u>Onsite Ex-situ Treatment</u> Incineration, Thermal Desorption, Asphalt Batching, Ex-situ Stabilization/Solidification	Any saturated soils will need to be drained prior to thermal treatment, batching, or stabilization. If the byproduct remained on-site, it would impact future land use.	Mixed organic and inorganic contaminants limit the ability for one single treatment method to be effectively implemented. Thermal treatment is suited for organics. Most S/S technologies have limited effectiveness against organics. Asphalt batching generally requires less than 2 ppm PCBs. Also, pilot testing is often warranted because of soil and contaminant conditions. Land disposal restrictions may apply because of elevated chromium and lead.	Eliminated.	

TABLE 4-1
SCREENING OF SOIL TECHNOLOGIES AND PROCESS OPTIONS

AOC 57
FOCUSED FEASIBILITY STUDY REPORT

DEVENS, MASSACHUSETTS

	Applicability To			
General Response Action/ Technology	Site-Limiting Characteristics	Waste-Limiting Characteristics	Screening Status	Comments
In-Situ Treatment				
Bioventing	Bioventing would require lowering the water table prior to treatment.	Inorganic contaminants limit the ability for bioventing to be effectively implemented. Also treatability and pilot testing is often warranted because of soil and contaminant conditions. Land disposal restrictions would likely apply because of elevated chromium and lead.	Eliminated.	
Disposal				
Devens Consolidation Landfill	Available space for disposal may be limited for use as cover material. Landfill construction is not definite at this time.	Concentrations of contaminants in extreme hot spot areas may exceed allowable contaminant levels for soil reuse as cover material.	Retained.	Retained for further consideration as an alternative to off-site treatment or disposal.
TSD Facility	Implementable. Many off-site vendors available who treat/dispose.	Facilities provide treatment/disposal/reuse. Must comply with Land Disposal Restrictions.	Retained.	

Notes:

NCP = National Contingency Plan
TSD = treatment, storage, and disposal

TABLE 4-2
SCREENING OF GROUNDWATER TECHNOLOGIES AND PROCESS OPTIONS

AOC 57
FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MASSACHUSETTS

	Applicability To			
General Response Action/ Process Option	Site-Limiting Characteristics	Waste-Limiting Characteristics	Screenin g Status	Comments
No Action				
None	None Easily implementable	None.	Retained.	Required for consideration by NCP. Does not achieve remedial action objectives.
Limited Action				
Zoning Restrictions, Deed Restrictions	Would prohibit potable well installations within the aquifer of Areas 2 and/or 3. Easy to implement considering future use of the area.	Does not reduce toxicity, mobility, or volume of contaminants but relies on preventing exposure by limiting access.	Retained.	
Groundwater Monitoring, Surface Water Monitoring	Groundwater discharges to Cold Spring Brook with no significant ecological impacts. Groundwater monitoring wells currently exist on site and may be used in a groundwater monitoring program	Monitoring would enable assessment of changes in contaminant concentrations over time.	Retained.	Fence maintenance could be evaluated during the periods of groundwater/surface water monitoring.
Collection				
Interceptor Trenches, Extraction Wells	Implementable. (See "Treatment" and "Disposal" options).	Effective technology to passively or actively collect contaminated groundwater for treatment/discharge.	Eliminated.	Collection was contingent upon the screening status of treatment and discharge.
Treatment				
Air Stripping, Activated Carbon, Metals Removal, In-situ Bioremediation	Implementable. However, PRG exceedances are sporadic and need for treatment questionable.	Mixed organic and inorganic contaminants require several processes for effective treatment.	Eliminated.	The most significant risk contributor is arsenic which is believed to be primarily naturally occurring as a result of anaerobic biological activity of organic constituents. Arsenic concentrations may decrease following removal of petroleum source areas.
Fort Devens WWTP	Would require piping groundwater to existing Fort Devens sewer system.	Fort Devens has a primary wastewater treatment facility, not designed to treat toxic contaminants.	Eliminated.	
Ayer POTW	Would require piping or trucking groundwater to Ayer sewer system.	Untreated groundwater would not meet pre-treatment standards for total toxic organics (1 mg/l).	Eliminated.	

Table 4-2
Screening of Groundwater Technologies and Process Options

AOC 57
Focused Feasibility Study Report
Devens, Massachusetts

General Response Action/ Process Option	Applicability to: Site-Limiting Characteristics	Applicability to: Waste-Limiting Characteristics	Screening Status	Comments
Discharge				
Devens WWTP	Would require pretreatment and discharge would be to the existing Devens sewer system. Facility currently has a notice of non-compliance.	Devens has a primary wastewater treatment facility which is not designed to treat inorganics and toxic pollutants. Groundwater would need to be treated to meet industrial pretreatment requirements.	Eliminated.	
To Groundwater	Requires on-site treatment which has been eliminated from further consideration.	Requires on-site treatment which has been eliminated from further consideration.	Eliminated.	
Ayer POTW	Would require piping or trucking groundwater to Ayer sewer system.	Groundwater would also need to be treated to acceptable discharge standards (total toxic organics).	Eliminated.	Discharge to the Ayer POTW offers no significant advantage over discharge to the Devens WWTP. Both alternatives require pre-treatment. The Ayer POTW option requires greater capital investment for piping or O&M for trucking.
Surface Water	Requires on-site treatment which has been eliminated from further consideration. NPDES permit required for off-site discharge. Negative public perception.	Requires on-site treatment which has been eliminated from further consideration.	Eliminated.	

Notes:

NCP = National Contingency Plan
MCLs = maximum contaminant levels
WWTP = waste water treatment plant
POTW = publicly owned treatment works
NPDES = National Pollutant Discharge Elimination System
UV = ultraviolet

TABLE 4-3
AREA 2 - WETLANDS
REMEDIAL ALTERNATIVE DEVELOPMENT
AOC 57
FOCUSED FEASIBILITY STUDY REPORT
DEVENS MASSACHUSETTS

ALTERNATIVE	COMPONENTS	RAOs ACHIEVED
II-1 - No Action	- No action implemented	- Does not meet RAOs
II-2 - Limited Action	Soils: - Implement land use restrictions to prohibit construction activities and residential use. Groundwater: - Implement deed restrictions to prohibit installation of potable wells in the wetland area and to provide advisories for installation of potable wells in the adjacent upland area. - Perform regularly scheduled groundwater and surface water monitoring at Cold Spring Brook.	- Minimizes exposure to Aroclor 1260, arsenic, lead, chromium, and C11-C22 - Prevents groundwater containing arsenic and tetrachloroethylene at concentrations above MCLs/MMCLs from being ingested by residential receptors. - Groundwater monitoring will be performed until arsenic and tetrachloroethylene PRGs are achieved and the groundwater deed restriction is removed. - Naturally occurring arsenic will likely revert back to a more insoluble form upon removal of petroleum contaminated soils. - Groundwater discharges into Cold Spring Brook. Surface water monitoring would be performed to verify that off-site migration of COCs above PRGs is not occurring.
II-3 - Excavation (For Possible Future Use) & Institutional Controls	Soils: - Excavate soils with COCs that exceed PRGs that are protective for possible future use (construction worker) - Implement land use restrictions to prohibit residential use. Groundwater: - Implement deed restrictions to prohibit installation of potable wells in the wetland area and to provide advisories for installation of potable wells in the adjacent upland area. - Perform regularly scheduled groundwater and surface water monitoring at Cold Spring Brook.	- Removes exposure to Aroclor 1260 and lead that are above concentrations protective of the construction worker receptor. - Minimizes residential exposure to Aroclor 1260, arsenic, lead, chromium, and C11-C22. - Same as Alternative II-2. - Same as Alternative II-2.

TABLE 4-3
AREA 2 - WETLANDS
REMEDIAL ALTERNATIVE DEVELOPMENT
AOC 57
FOCUSED FEASIBILITY STUDY REPORT
DEVENS MASSACHUSETTS

ALTERNATIVE	COMPONENTS	RAOs ACHIEVED
II-4 - Excavation (For Unrestricted Use) & Institutional Controls	<u>Soils:</u> - Excavate wetland area soils with COCs that exceed PRGs that are protective for unrestricted use (residential)	- Removes exposure to Aroclor 1260, arsenic, lead, chromium, and C11-C22 that are above concentrations protective of the residential receptor.
	<u>Groundwater:</u> - Implement deed restrictions to prohibit installation of potable wells in the wetland area and to provide advisories for installation of potable wells in the adjacent upland area.	- Same as Alternative II-2.
	- Perform regularly scheduled groundwater and surface water monitoring at Cold Spring Brook.	- Same as Alternative II-2.

TABLE 4-4
AREA 3 - UPLANDS AND WETLANDS
REMEDIAL ALTERNATIVE DEVELOPMENT
AOC 57
FOCUSED FEASIBILITY STUDY REPORT
DEVENS MASSACHUSETTS

ALTERNATIVE	COMPONENTS	RAOs ACHIEVED
III-1 - No Action	- No action implemented	- Does not meet RAOs
III-2 - Limited Action	Soils: - Implement land use restrictions to prohibit residential use. Groundwater: - Implement deed restrictions to prohibit well installation for potable use in upland and wetland areas. - Perform regularly scheduled groundwater and surface water monitoring at Cold Spring Brook.	- Minimizes residential exposure to C11-C22 aromatic compounds. - Prevents groundwater containing arsenic, tetrachloroethylene, cadmium, and 1,4-dichlorobenzene at concentrations above MCLs/MMCLs from being ingested by commercial/industrial and residential receptors. - Groundwater monitoring will be performed until arsenic, tetrachloroethylene, cadmium, and 1,4-dichlorobenzene PRGs are achieved and the groundwater deed restriction is removed. - Naturally occurring arsenic will likely revert back to a more insoluble form upon removal of petroleum contaminated soils. - Groundwater discharges into Cold Spring Brook. Surface water monitoring would be performed to verify that off-site migration of COCs above PRGs is not occurring.
III-3 - Excavation (For Unrestricted Use) & Institutional Controls	Soils: - Excavate wetland area soils with COCs that exceed PRGs that are protective for unrestricted use (residential) Groundwater: - Implement deed restrictions to prohibit well installation for potable use in upland and wetland areas. - Perform regularly scheduled groundwater and surface water monitoring at Cold Spring Brook.	- Removes exposure to C11-C22 compounds that are above concentrations protective of residential receptors. - Same as Alternative III-2 - Same as Alternative III-2

TABLE 5-1
AREA 2 WETLANDS
SCREENING OF ALTERNATIVE II-2: LIMITED ACTION
AOC 57

FOCUSED FEASIBILITY STUDY
DEVENS, MASSACHUSETTS

Components: Land-use restrictions (for soil and aquifer); and environmental sampling.

EFFECTIVENESS	IMPLEMENTABILITY	COST
Advantages	Advantages	Advantages
• Public access to the site would be restricted to minimize risk.	• Easily implementable because no remedial actions would occur.	• Capital costs would be minimal for deed restrictions.
• Site would be monitored for groundwater COC migration.	• Access restrictions at the AOC 57 would be easily implementable given future use as open space.	
• Low potential for exposure to contamination during implementation.		
• Deed restrictions would reliably maintain long-term remedial action compliance.		
Disadvantages	Disadvantages	Disadvantages
• Would not reduce toxicity, mobility, or volume of contaminants through treatment.	• Administrative oversight and agency coordination is required for institutional controls (soil and groundwater restrictions).	• Long-term monitoring and land-use restriction costs would be incurred. Monitoring and deed restrictions (soil and aquifer) are assumed to be required indefinitely.
• Soil and groundwater COCs remain on-site.		

Conclusion: Alternative II-2 is **retained** for detailed evaluation.

TABLE 5-2
AREA 2 WETLANDS
SCREENING OF ALTERNATIVE II-3:
EXCAVATION (FOR POSSIBLE FUTURE USE) AND INSTITUTIONAL CONTROLS
AOC 57

FOCUSED FEASIBILITY STUDY
DEVENS, MASSACHUSETTS

Components: Soil excavation to achieve possible future-use PRGs; soil removal to an off-site TSD; land-use restrictions (for residential soil and groundwater exposure); and environmental sampling.

EFFECTIVENESS	IMPLEMENTABILITY	COST
Advantages • Excavation would remove soil with COC concentrations above possible future-use PRGs (e.g., reduce risk to recreational and construction exposures). • Excavation would reduce volume of contaminants at site soils. • Deed restrictions would minimize risk from residential exposure to site soil and potable use of groundwater. • Site would be monitored for groundwater COC migration. • Remedial action compliance would be reliably maintained with soil excavation and deed restrictions.	Advantages • Excavation is readily implementable using standard construction practices. • Excavated soils would be removed from the site and handled by an licensed TSD facility. • Deed restrictions limiting residential use of wetlands would be easily enforced.	Advantages • Additional soil removal may reduce the duration of long-term groundwater monitoring and groundwater deed restrictions. Soil removal may hasten the raising of groundwater ORP to background conditions. Low ORP is likely contributing to higher arsenic solubility and arsenic PRG exceedance in groundwater.
Disadvantages • Potential for worker exposure during excavation of contaminated soil. • Soil and groundwater COCs remain on-site.	Disadvantages • Would require restoration for wetlands disturbed from soil removal activities. • Administrative oversight and agency coordination is required for institutional controls (soil and groundwater restrictions).	Disadvantages • Higher capital costs because of excavation and off-site TSD costs; a larger wetland area would require restoration. • Groundwater benefits from soil removal not readily quantifiable. (e.g., possible reduction in long-term monitoring duration is not readily measurable.)

Conclusion: Alternative II-3 is **retained** for detailed evaluation.

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TABLE 5-3
AREA 2 WETLANDS
SCREENING OF ALTERNATIVE II-4:
EXCAVATION (FOR UNRESTRICTED USE) AND INSTITUTIONAL CONTROLS
AOC 57

FOCUSED FEASIBILITY STUDY
DEVENS, MASSACHUSETTS

Components: Soil excavation to achieve residential-use PRGs; soil removal to an off-site TSD; land-use restrictions (for residential groundwater exposure); and environmental sampling.

EFFECTIVENESS	IMPLEMENTABILITY	COST
Advantages • Excavation would remove soil with COC concentrations above unrestricted-use PRGs (e.g., reduce risk to residential exposures). • Excavation would reduce volume of contaminants at site soils. • Deed restrictions would minimize risk from potable use of residential exposure to site groundwater. • Site would be monitored for groundwater COC migration. • Remedial action compliance would be reliably maintained with soil excavation and deed restrictions.	Advantages • Excavation is readily implementable using standard construction practices. • Excavated soils would be removed from the site and handled by a licensed TSD facility. • Deed restrictions limiting residential use of the wetland aquifer would be easily enforced. • Deed restrictions limiting residential use of site soils would not be required.	Advantages • Additional soil removal may reduce the duration of long-term groundwater monitoring and groundwater deed restrictions. Soil removal may hasten the raising of groundwater ORP to background conditions. Low ORP is likely contributing to higher arsenic solubility and arsenic PRG exceedance in groundwater.
Disadvantages • Potential for worker exposure during excavation of contaminated soil. • Groundwater COCs remain on-site.	Disadvantages • Would require greater restoration for wetlands disturbed from soil removal activities than for the other alternatives. • Administrative oversight and agency coordination is required for institutional controls (groundwater restrictions).	Disadvantages • Higher capital costs because of excavation and off-site TSD costs, plus a larger wetland area would require restoration, and monitoring. • Groundwater benefits from soil removal not readily quantifiable. (i.e, possible reduction in long-term monitoring duration is not readily measurable.)

Conclusion: Alternative II-4 is **retained** for detailed evaluation.

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TABLE 5-4
AREA 3 UPLANDS & WETLANDS
SCREENING OF ALTERNATIVE III-2: LIMITED ACTION
AOC 57

FOCUSED FEASIBILITY STUDY
DEVENS, MASSACHUSETTS

Components: Land-use restrictions prohibiting commercial/industrial and residential use of the upland and wetland aquifer, and residential use of the wetland soil; and environmental sampling.

EFFECTIVENESS	IMPLEMENTABILITY	COST
Advantages • Commercial/industrial and residential use of the site would be restricted to minimize risk. • Site would be monitored for groundwater COC migration. • No exposure to contamination during implementation. • Deed restrictions would reliably maintain long-term remedial action compliance.	Advantages • Easily implementable because no remedial actions would occur. • Restrictions prohibiting residential use at the AOC 57 would be easily implementable given that it is near/within a wetland area and its future use is slated as open space.	Advantages • Capital costs would be minimal for implementing deed restrictions.
Disadvantages • Would not reduce toxicity, mobility, or volume of contaminants through treatment. • Soil and groundwater COCs remain on-site.	Disadvantages • Administrative oversight and agency coordination is required for institutional controls (soil and groundwater restrictions).	Disadvantages • Long-term monitoring and deed restriction (soil and aquifer) costs would be incurred and are assumed to be required indefinitely.

Conclusion: Alternative III-2 is **retained** for detailed evaluation.

TABLE 5-5
AREA 3 UPLANDS & WETLANDS
SCREENING OF ALTERNATIVE III-3:
EXCAVATION (FOR UNRESTRICTED USE) AND INSTITUTIONAL CONTROLS
AOC 57

FOCUSED FEASIBILITY STUDY
DEVENS, MASSACHUSETTS

Components: Soil excavation to achieve residential-use PRGs; soil removal to an off-site TSD; Land-use restrictions prohibiting commercial/industrial and residential potable use of the upland and wetland aquifer; and environmental sampling.

EFFECTIVENESS	IMPLEMENTABILITY	COST
Advantages • Excavation would remove soil with COC concentrations above unrestricted-use PRGs (e.g., reduce risk to residential exposures). • Excavation would reduce volume of contaminants at site wetland soils. • Deed restrictions would minimize risk from commercial/industrial and residential exposure to site groundwater. • Site would be monitored for groundwater COC migration. • Remedial action compliance reliably maintained with soil excavation and deed restrictions.	Advantages • Excavation is readily implementable using standard construction practices. • Excavated soils would be removed from the site and handled by a licensed TSD facility. • Deed restrictions limiting residential use of the upland and wetland aquifer would be easily enforced. • Deed restrictions limiting residential use of site soils would not be required.	Advantages • Additional soil removal may reduce the duration of long-term groundwater monitoring and groundwater deed restrictions. Soil removal may hasten the raising of groundwater ORP to background conditions. Low ORP is likely contributing to higher arsenic solubility and arsenic PRG exceedance in groundwater.
Disadvantages • Potential for worker exposure during excavation of contaminated soil. • Groundwater COCs remain on-site.	Disadvantages • Would require restoration for wetlands disturbed from soil removal activities. • Administrative oversight and agency coordination is required for institutional controls (groundwater restrictions).	Disadvantages • Higher capital costs because of excavation, off-site TSD costs and wetland area restoration. • Groundwater benefits from soil removal not readily quantifiable. (i.e, possible reduction in long-term monitoring duration is not readily measurable.)

Conclusion: Alternative III-3 is **retained** for detailed evaluation.

TABLE 6-1
SYNOPSIS OF FEDERAL AND STATE CHEMICAL-SPECIFIC ARARs FOR ALTERNATIVE II-1 (NO ACTION)

AOC 57 FEASIBILITY STUDY
DEVENS, MA

REGULATORY AUTHORITY	CHEMICAL MEDIUM	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
Federal	Groundwater	Safe Drinking Water Act, National Primary Drinking Water Regulations, MCLs and MCLGs [40 CFR Parts 141.60 - 141.63 and 141.50 - 141.52]	Relevant and Appropriate	The National Primary Drinking Water Regulations establish MCLs and MCLGs for several common organic and inorganic contaminants. MCLs specify the maximum permissible concentrations of contaminants in public drinking water supplies. MCLs are federally enforceable standards based in part on the availability and cost of treatment techniques. MCLGs specify the maximum concentration at which no known or anticipated adverse effect on humans will occur. MCLGs are non-enforceable health based goals set equal to or lower than MCLs.	The MCLs for arsenic and PCE will likely be met through natural attenuation processes. However, no monitoring would be performed to measure changes in contaminant concentrations or migration; therefore attainment of groundwater ARARs would not be confirmed at the two locations (57M-95-04A and 57P-98-02X), where MCL exceedances were detected.
State	Groundwater	Massachusetts Groundwater Quality Standards [314 CMR 6.00]	Relevant and Appropriate	These standards designate and assign uses for which groundwaters of the Commonwealth shall be maintained and protected, and set forth water quality criteria necessary to maintain the designated uses. Groundwater at Devens is classified as Class I, fresh groundwaters designated as a source of potable water supply.	The concentrations of arsenic and PCE in groundwater will likely achieve MMCLs through natural attenuation processes. However, no monitoring will be performed to measure changes in contaminant concentrations or migration; therefore attainment of groundwater MMCLs would not be confirmed at the two locations (57M-95-04A and 57P-98-02X).
	Groundwater	Massachusetts Drinking Water Regulations [310 CMR 22.00]	Relevant and Appropriate	These regulations list MMCLs which apply to drinking water distributed through a public water system.	As previously stated, Devens groundwater is classified as Class1, and designated as a source of potable water supply. However, no environmental monitoring program would be established under this alternative. AOC 57 is currently not within a Zone I or II/Interim Wellhead Protection Area. Because Devens has a municipal water supply, any future construction at AOC 57 would be supplied with municipal water.

Notes:
AOC = Area of contamination
ARARs = Applicable or Relevant and Appropriate Requirements
CFR = Code of Federal Regulations
CMR = Code of Massachusetts Rules
MCL = Maximum Contaminant Level
MCLG = Maximum Contaminant Level Goal
MMCL = Massachusetts Maximum Contaminant Level
PCE = Tetrachloroethylene

Table 6-2
Synopsis of Federal and State LOCATION-Specific ARARs For Alternative II-1 (No Action)

AOC 57 Feasibility Study
Devens, MA

Regulatory Authority	Location Characteristic	Requirement	Status	Requirement Synopsis	Action To Be Taken To Attain Requirement
Federal/State	No location-specific ARARs are triggered.				

Table 6-3
Synopsis of Federal and State ACTION-Specific ARARs For Alternative II-1 (No Action)

AOC 57 Feasibility Study
Devens, MA

Regulatory Authority	Action	Requirement	Status	Requirement Synopsis	Action To Be Taken To Attain Requirement
Federal/State	No action-specific ARARs are triggered.				

Notes:

ARARs = Applicable or Relevant and Appropriate Requirements

TABLE 6-4
SYNOPSIS OF FEDERAL AND STATE CHEMICAL-SPECIFIC ARARs FOR ALTERNATIVE II-2 (LIMITED ACTION)

AOC 57 FEASIBILITY STUDY
DEVENS, MA

REGULATORY AUTHORITY	CHEMICAL MEDIUM	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
Federal	Groundwater	Safe Drinking Water Act, National Primary Drinking Water Regulations, MCLs and MCLGs [40 CFR Parts 141.60 - 141.63 and 141.50 – 141.52]	Relevant and Appropriate	The National Primary Drinking Water Regulations establish MCLs and MCLGs for several common organic and inorganic contaminants. MCLs specify the maximum permissible concentrations of contaminants in public drinking water supplies. MCLs are federally enforceable standards based in part on the availability and cost of treatment techniques. MCLGs specify the maximum concentration at which no known or anticipated adverse effect on humans will occur. MCLGs are non-enforceable health based goals set equal to or lower than MCLs.	The MCLs for arsenic and PCE will likely be met through natural attenuation processes. Monitoring would be performed to measure changes in contaminant concentrations or migration; therefore attainment of groundwater ARARs would eventually be confirmed at the two locations (57M-95-04A and 57P-98-02X), where MCL exceedances were detected.
State	Groundwater	Massachusetts Groundwater Quality Standards [314 CMR 6.00]	Relevant and Appropriate	These standards designate and assign uses for which groundwaters of the Commonwealth shall be maintained and protected, and set forth water quality criteria necessary to maintain the designated uses. Groundwater at Fort Devens is classified as Class I, fresh groundwaters designated as a source of potable water supply.	314 CMR 6.00 would be met by achieving MMCLs for arsenic and PCE. The MMCLs for arsenic and PCE will likely be met through natural attenuation processes. Monitoring would be performed to measure changes in contaminant concentrations or migration; therefore attainment of groundwater MMCLs would eventually be confirmed at the two locations (57M-95-04A and 57P-98-02X).
	Groundwater	Massachusetts Drinking Water Regulations [310 CMR 22.00]	Relevant and Appropriate	These regulations list MMCLs which apply to drinking water distributed through a public water system.	As previously stated, Devens groundwater is classified as Class1, and designated as a source of potable water supply. AOC 57 is currently not within a Zone I or II/Interim Wellhead Protection Area. An AUL would be established at Area 2 until the environmental monitoring program indicates that MMCLs have been achieved for at least three years.

Notes:
AOC = Area of contamination
ARARs = Applicable or Relevant and Appropriate Requirements
AUL = Activity and Use Limitations
CFR = Code of Federal Regulations
CMR = Code of Massachusetts Rules
MCL = Maximum Contaminant Level
MCLG = Maximum Contaminant Level Goal
MMCL = Massachusetts Maximum Contaminant Level
PCE = Tetrachloroethylene

Table 6-5
Synopsis of Federal and State LOCATION-Specific ARARs For Alternative II-2 (Limited Action)

AOC 57 Feasibility Study
Devens, MA

Regulatory Authority	Location Characteristic	Requirement	Status	Requirement Synopsis	Action To Be Taken To Attain Requirement
Federal/State	No location-specific ARARs are triggered.				

Notes:

ARARs = Applicable or Relevant and Appropriate Requirements

TABLE 6-6
SYNOPSIS OF FEDERAL AND STATE ACTION-SPECIFIC ARARS FOR ALTERNATIVE II-2 (LIMITED ACTION)

AOC 57 FEASIBILITY STUDY
DEVENS, MA

REGULATORY AUTHORITY	Action	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
Federal/State	Groundwater.	USEPA OSWER Publication 9345.3-03FS, January 1992	To Be Considered	Management of IDW must ensure protection of human health and the environment.	IDW produced from well sampling will comply with ARARs.

Notes:

ARARs = Applicable or Relevant and Appropriate Requirements
IDW = Investigation-derived waste
USEPA = U.S. Environmental Protection Agency

TABLE 6-7
SYNOPSIS OF FEDERAL AND STATE CHEMICAL-SPECIFIC ARARS FOR ALTERNATIVE II-3
AOC 57 FEASIBILITY STUDY
DEVENS, MA

REGULATORY AUTHORITY	CHEMICAL MEDIUM	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
Federal	Groundwater	Safe Drinking Water Act, National Primary Drinking Water Regulations, MCLs and MCLGs [40 CFR Parts 141.60 - 141.63 and 141.50 - 141.52]	Relevant and Appropriate	The National Primary Drinking Water Regulations establish MCLs and MCLGs for several common organic and inorganic contaminants. MCLs specify the maximum permissible concentrations of contaminants in public drinking water supplies. MCLs are federally enforceable standards based in part on the availability and cost of treatment techniques. MCLGs specify the maximum concentration at which no known or anticipated adverse effect on humans will occur. MCLGs are non-enforceable health based goals set equal to or lower than MCLs.	The MCLs for arsenic and PCE will likely be met through natural attenuation processes. Monitoring would be performed to measure changes in contaminant concentrations or migration; therefore attainment of groundwater ARARs would eventually be confirmed at the two locations (57M-95-04A and 57P-98-02X), where MCL exceedances were detected.
State	Groundwater	Massachusetts Groundwater Quality Standards [314 CMR 6.00]	Relevant and Appropriate	These standards designate and assign uses for which groundwaters of the Commonwealth shall be maintained and protected, and set forth water quality criteria necessary to maintain the designated uses. Groundwater at Fort Devens is classified as Class I, fresh groundwaters designated as a source of potable water supply.	314 CMR 6.00 would be met by achieving MMCLs for arsenic and PCE. The MMCLs for arsenic and PCE will likely be met through natural attenuation processes. Monitoring would be performed to measure changes in contaminant concentrations or migration; therefore attainment of groundwater MMCLs would eventually be confirmed at the two locations (57M-95-04A and 57P-98-02X).
	Groundwater	Massachusetts Drinking Water Regulations [310 CMR 22.00]	Relevant and Appropriate	These regulations list MMCLs which apply to drinking water distributed through a public water system.	As previously stated, Devens groundwater is classified as Class1, and designated as a source of potable water supply. AOC 57 is currently not within a Zone I or II/Interim Wellhead Protection Area. An AUL would be established at Area 2 until the environmental monitoring program indicates that MMCLs have been achieved for at least three years.

Notes:

AOC	=	Area of contamination
ARARs	=	Applicable or Relevant and Appropriate Requirements
CFR	=	Code of Federal Regulations
CMR	=	Code of Massachusetts Rules
MCL	=	Maximum Contaminant Level
MCLG	=	Maximum Contaminant Level Goal
MMCL	=	Massachusetts Maximum Contaminant Level
PCE	=	Tetrachloroethylene

TABLE 6-8
SYNOPSIS OF FEDERAL AND STATE LOCATION-SPECIFIC ARARS FOR ALTERNATIVE II-3

AOC 57FEASIBILITY STUDY
DEVENS, MA

REGULATORY AUTHORITY	LOCATION CHARACTERISTIC	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
Federal	Floodplains	Floodplain Management Executive Order 11988 [40 CFR Part 6, Appendix A]	Applicable	Requires federal agencies to evaluate the potential adverse effects associated with direct and indirect development of a floodplain. Alternatives that involve modification/construction within a floodplain may not be selected unless a determination is made that no practicable alternative exists. If no practicable alternative exists, potential harm must be minimized and action taken to restore and preserve the natural and beneficial values of the floodplain.	Contaminated soil removal will be designed to minimize alteration/destruction of the floodplain area. If this alternative is chosen, floodplains affected by Remedial Investigation will be restored to original elevations.
	Wetlands	Protection of Wetlands Executive Order 11990 [40 CFR Part 6, Appendix A]	Applicable	Under this Order, federal agencies are required to minimize the destruction, loss, or degradation of wetlands, and preserve and enhance natural and beneficial values of wetlands. If remediation is required within wetland areas, and no practical alternative exists, potential harm must be minimized and action taken to restore natural and beneficial values.	Contaminated soil removal will be designed to minimize alteration/destruction of the wetlands. If this alternative is chosen, the wetlands will be restored.
	Wetlands, Aquatic Ecosystem	Clean Water Act, Dredge or Fill Requirements Section 404 [40 CFR Part 230]	Relevant and Appropriate	Section 404 of the CWA regulates the discharge of dredged or fill materials to U.S. waters, including wetlands. Filling wetlands would be considered a discharge of fill materials. Guidelines for Specification of Disposal Sites for Dredged or Fill material at 40 CFR Part 230, promulgated under CWA Section 404(b)(1), maintain that no discharge of dredged or fill material will be permitted if there is a practical alternative that would have less effect on the aquatic ecosystem. If adverse impacts are unavoidable, action must be taken to restore, or create alternative wetlands.	The removal of soil will be designed for eventual restoration. A Massachusetts PGP (granted by USACE) is typically required prior to excavating/restoring any sediment. The substantive portions of the permit would potentially be required.
	Surface Waters, Endangered Species, Migratory Species	Fish and Wildlife Coordination Act [16 USC 661 et seq.]	Relevant and Appropriate	Actions that affect species/habitat require consultation with USDOI, USFWS, NMFS, and/or state agencies, as appropriate, to ensure that proposed actions do not jeopardize the continued existence of the species or adversely modify or destroy critical habitat. The effects of water-related	To the extent necessary, actions will be taken to develop measures to prevent, mitigate, or compensate for project related impacts to habitat and wildlife. The USFWS, acting as a review agency for the USEPA, will be kept informed of proposed Remedial

Table 6-8
Synopsis of Federal and State Location-Specific ARARs for Alternative II-3

AOC 57Feasibility Study
Devens, MA

Regulatory Authority	Location Characteristic	Requirement	Status	Requirement Synopsis	Action To Be Taken To Attain Requirement
				projects on fish and wildlife resources must be considered. Action must be taken to prevent, mitigate, or compensate for project-related damages or losses to fish and wildlife resources. Consultation with the responsible agency is also strongly recommended for on-site actions. Under 40 CFR Part 300.38, these requirements apply to all response activities under the NCP.	Investigations.
	Endangered Species	Endangered Species Act [50 CFR Parts 17.11-17.12]	Relevant and Appropriate	This act requires action to avoid jeopardizing the continued existence of listed endangered or threatened species or modification of their habitat.	According to the RI report, no endangered federally-listed species have been identified within one mile of the AOC 57. However, protection of endangered species and their habitat will be considered as part of the design and excavation activities.
	Atlantic Flyway, Wetlands, Surface Waters	Migratory Bird Treaty Act [16 USC 703 et seq.]	Relevant and Appropriate	The Migratory Bird Treaty Act protects migratory birds, their nests, and eggs. A depredation permit is required to take, possess, or transport migratory birds or disturb their nests, eggs, or young.	Remedial Investigations will be performed to protect migratory birds, their nests, and eggs.
State	Floodplains, Wetlands, Surface Waters	Massachusetts Wetland Protection Regulations [310 CMR 10.00]	Applicable	These regulations include standards on dredging, filling, altering, or polluting inland wetlands and protected areas (defined as areas within the 100-year floodplain). A NOI must be filed with the municipal conservation commission and a Final Order of Conditions obtained before proceeding with the activity. A Determination of Applicability or NOI must be filed for activities such as excavation within a 100 foot buffer zone. The regulations specifically prohibit loss of over 5,000 square feet of bordering vegetated wetland. Loss may be permitted with replication of any lost area within two growing seasons.	All work to be performed within wetlands and the 100 foot buffer zone will be in accordance with the substantive requirements of these regulations.
	Endangered Species	Massachusetts Endangered Species Regulations [321 CMR 8.00]	Applicable	Actions must be conducted in a manner that minimizes the impact to Massachusetts-listed rare, threatened, or endangered species, and species listed by the	The RI report identified several state-listed rare, threatened, or endangered species occurring within one mile of AOC 57. The protection of state listed endangered species will be considered during the design and

TABLE 6-8
SYNOPSIS OF FEDERAL AND STATE LOCATION-SPECIFIC ARARS FOR ALTERNATIVE II-3

AOC 57FEASIBILITY STUDY
DEVENS, MA

REGULATORY AUTHORITY	LOCATION CHARACTERISTIC	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
				Massachusetts Natural Heritage Program.	implementation of this alternative.

Notes:

AOC	=	Area of contamination
ARAR	=	Area of Contamination
CFR	=	Code of Federal Regulations
CMR	=	Code of Massachusetts Regulations
CWA	=	Clean Water Act
USDOI	=	U.S. Department of the Interior
USFWS	=	U.S. Fish and Wildlife Service
NCP	=	National Contingency Plan
NMFS	=	National Maine Fisheries Service
NOI	=	Notice of Intent
PGP	=	Programatic General Permit
RI	=	Remedial Investigation
USACE	=	U.S. Army Corps of Engineers
USEPA	=	U.S. Environmental Protection Agency
USC	=	United States Code

TABLE 6-9
SYNOPSIS OF FEDERAL AND STATE ACTION-SPECIFIC ARARS FOR ALTERNATIVE II-3

AOC 57 FEASIBILITY STUDY
DEVENS, MA

REGULATORY AUTHORITY	ACTION	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
Federal	Control of surface water runoff, Direct discharge to surface water	Clean Water Act NPDES Permit Program [40 CFR 122,125]	Relevant and Appropriate	The NPDES permit program specifies the permissible concentration or level of contaminants in the discharge from any point source, including surface runoff, to waters of the United States.	Construction activities will be controlled to meet USEPA discharge requirements. Water collected from dewatering and stockpile activities will be collected and treated offsite or discharged to the Devens WWTP. Any on-site runoff discharges (though none expected) will meet the substantive requirements of these regulations.
	Discharge to Devens Treatment Plant	CWA, General Pretreatment Program (40 CFR Part 403)	Applicable	Discharge of nondomestic wastewater to WWTP must comply with the general prohibitions of this regulation, as well as categorical standards, and local pretreatment standards.	Discharge to Devens WWTP would be sampled to evaluate compliance with pre-treatment standards.
	Groundwater	USEPA OSWER Publication 9345.3-03FS, January 1992	To Be Considered	Management of IDW must ensure protection of human health and the environment.	IDW produced from well sampling will comply with ARARs.
	RCRA - Identification and Listing of Hazardous Wastes	Toxicity Characteristics (40 CFR 261.24)	Applicable	Defines those wastes that are subject to regulations as hazardous wastes under 40 CFR Parts 124 and 264.	Soil/sediment analytical results will be evaluated against the criteria and definitions of hazardous waste. The criteria and definition of hazardous waste will be referred to and utilized in development of the Remedial Investigation.
	Disposal of soil that contains hazardous waste	RCRA, Land Disposal Restrictions (40 CFR 268)	Applicable	Land disposal of RCRA hazardous wastes without specified treatment is restricted. LDRs require that such wastes must be treated either by a treatment technology or to a specific concentration prior to disposal in a RCRA Subtitle C permitted facility.	Waste materials from Area 2 will be evaluated to determine whether the waste is subject to LDRs. If so, the materials will be treated in accordance with LDRs prior to disposal at an off-base facility.
	Management of PCB-contaminated soil	TSCA (40 CFR Part 761 Subpart G) PCB Spill Cleanup Policy	To be considered	This policy governs the cleanup of PCB spills occurring after May 4, 1987. Because this policy isnot a regulation and only applies to recent spills (reported within 24hours of occurrence), these requirements are not applicable, but will be considered.	This policy would only be considered during the development of Remedial Investigation for areas with expected detected PCBs at concentrations greater than or equal to 50 ppm. The highest concentration of PCBs in soil was detected during the RI at 12 ppm.

TABLE 6-9
SYNOPSIS OF FEDERAL AND STATE ACTION-SPECIFIC ARARS FOR ALTERNATIVE II-3

AOC 57 FEASIBILITY STUDY
DEVENS, MA

REGULATORY AUTHORITY	ACTION	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
	Management of PCB-contaminated soil	TSCA (40 CFR Part 761 Subpart D) Storage and Disposal	Relevant and Appropriate	This regulation governs the storage and final disposal of PCBsl. The regulation also specifies procedures to be followed in decontaminating containers and moveable equipment used in storage areas. Section 761.61 pertains to PCB remediation wastes and provides self-implementing on-site cleanup and disposal requirements. Per Section 761.61, the self-implementing cleanup provisions are not binding for cleanups conducted under CERCLA.	Section 761.61 cleanup levels for low and high occupancy areas are ≤ 1 ppm, respectively. RI calculated RBCs for Aroclor – 1260 are more conservative and will be used as PRGs at AOC 57. Off-site storage, disposal and decontamination requirements specified in this regulation will be applied for soil or sediment containing PCBs.
State	Hazardous Waste	Hazardous Waste Management Systems; (RCRA 40 CFR 260)	Relevant and Appropriate	USEPA procedures for making information available to the public; rules for claims of business confidentially.	Does not address cleanup requirements. However, these procedures will be followed when dealing with hazardous waste.
	Hazardous Waste	Standards for Owners and Operators of Hazardous Waste Treatment, Storage and Disposal Facilities (RCRA 40 CFR 264)	Relevant and Appropriate	Define requirements for RCRA facility operations and management including impoundments, wastepiles, land treatment, landfills, incinerators, storage, closure and post closure.	Operations, management and safety requirements in effect for all portions of remedial process, if hazardous waste is being handled.
	Hazardous Waste	RCRA 40 CFR Part 262, Standards Applicable to Generators of Hazardous Waste	Relevant and Appropriate	These regulations establish standards for generators of hazardous waste. RCRA Subtitle C established standards applicable to treatment, storage, and disposal of hazardous waste and closure of hazardous waste facilities.	Sediments will be tested to determine whether they contain characteristic hazardous waste. If so, management of the hazardous waste would comply with substantive requirements of these regulations.
	Hazardous Waste	Massachusetts Hazardous Waste Management Rules; 310 CMR 30.000	Relevant and Appropriate	These rules set forth Massachusetts definitions and criteria for establishing whether waste materials are hazardous and subject to associated hazardous waste regulations.	These regulations supplement RCRA requirements. Those criteria and definitions more stringent than RCRA take precedence over federal requirements.
	Activities that potentially affect surface water quality	Massachusetts Water Quality Certification and Certification for Dredging [314 CMR 9.00]	Relevant and Appropriate	A Massachusetts Division of Water Pollution Control Water Quality Certification is required pursuant to 314 CMR 9.00 for dredging-related activities in waters (including wetlands) within the Commonwealth which require federal licenses or permits and which are subject to state water quality certification.	Excavation and filling activities will meet the substantive criteria and standards of these regulations. Remedial activities will be designed to attain and maintain Massachusetts Water Quality Standards in affected waters.
	Activities that affect ambient air quality	Massachusetts Air Pollution Control Regulations	Applicable	These regulations pertain to the prevention of emissions in excess of Massachusetts	Remedial activities will be conducted to meet the standards for Visible Emissions (310 CMR 7.06); Dust,

TABLE 6-9
SYNOPSIS OF FEDERAL AND STATE ACTION-SPECIFIC ARARS FOR ALTERNATIVE II-3

AOC 57 FEASIBILITY STUDY
DEVENS, MA

REGULATORY AUTHORITY	ACTION	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
		[310 CMR 7.00]		ambient air quality standards.	Odor, Construction and Demolition (310 CMR 7.09); Noise (310 CMR 7.10); and Volatile Organic Compounds (310 CMR 7.18).

Notes:

ARARs	=	Applicable or Relevant and Appropriate Requirements
CFR	=	Code of Federal Regulations
CMR	=	Code of Massachusetts Regulations
CWA	=	Clean Water Act
IDW	=	Investigation derived waste
LDR	=	Land Disposal Restrictions
NPDES	=	National Pollutant Discharge Elimination System
RCBs	=	Risk-based concentrations
RCRA	=	Resource Conservation and Recovery Act
RI	=	Remedial Investigation
TSCA	=	Toxic Substances Control Act
PCB	=	Polychlorinated biphenyls
PRGs	=	preliminary remediation goals
USEPA	=	U.S. Environmental Protection Agency
WWTP	=	Wastewater Treatment Plant

TABLE 6-10
SYNOPSIS OF FEDERAL AND STATE CHEMICAL-SPECIFIC ARARS FOR ALTERNATIVE II-4

AOC 57 FEASIBILITY STUDY
DEVENS, MA

REGULATORY AUTHORITY	CHEMICAL MEDIUM	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
Federal	Groundwater	Safe Drinking Water Act, National Primary Drinking Water Regulations, MCLs and MCLGs [40 CFR Parts 141.60 - 141.63 and 141.50 – 141.52]	Relevant and Appropriate	The National Primary Drinking Water Regulations establish MCLs and MCLGs for several common organic and inorganic contaminants. MCLs specify the maximum permissible concentrations of contaminants in public drinking water supplies. MCLs are federally enforceable standards based in part on the availability and cost of treatment techniques. MCLGs specify the maximum concentration at which no known or anticipated adverse effect on humans will occur. MCLGs are non-enforceable health based goals set equal to or lower than MCLs.	The MCLs for arsenic and PCE will likely be met through natural attenuation processes. Monitoring would be performed to measure changes in contaminant concentrations or migration; therefore attainment of groundwater ARARs would eventually be confirmed at the two locations (57M-95-04A and 57P-98-02X), where MCL exceedances were detected.
State	Groundwater	Massachusetts Groundwater Quality Standards [314 CMR 6.00]	Relevant and Appropriate	These standards designate and assign uses for which groundwaters of the Commonwealth shall be maintained and protected, and set forth water quality criteria necessary to maintain the designated uses. Groundwater at Fort Devens is classified as Class I, fresh groundwaters designated as a source of potable water supply.	314 CMR 6.00 would be met by achieving MMCLs for arsenic and PCE. The MMCLs for arsenic and PCE will likely be met through natural attenuation processes. Monitoring would be performed to measure changes in contaminant concentrations or migration; therefore attainment of groundwater MMCLs would eventually be confirmed at the two locations (57M-95-04A and 57P-98-02X).
	Groundwater	Massachusetts Drinking Water Regulations [310 CMR 22.00]	Relevant and Appropriate	These regulations list MMCLs which apply to drinking water distributed through a public water system.	As previously stated, Devens groundwater is classified as Class1, and designated as a source of potable water supply. AOC 57 is currently not within a Zone I or II/Interim Wellhead Protection Area. An AUL would be established at Area 2 until the environmental monitoring program indicates that MMCLs have been achieved for at least three years.

Notes:

AOC = Area of contamination
ARARs = Applicable or Relevant and Appropriate Requirements
AUL = Activity and Use Limitations
CFR = Code of Federal Regulations
CMR = Code of Massachusetts Rules
MCL = Maximum Contaminant Level
MCLG = Maximum Contaminant Level Goal
MMCL = Massachusetts Maximum Contaminant Level
PCE = Tetrachloroethylene

TABLE 6-11
SYNOPSIS OF FEDERAL AND STATE LOCATION-SPECIFIC ARARS FOR ALTERNATIVE II-4

AOC 57FEASIBILITY STUDY
DEVENS, MA

REGULATORY AUTHORITY	LOCATION CHARACTERISTIC	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
Federal	Floodplains	Floodplain Management Executive Order 11988 [40 CFR Part 6, Appendix A]	Applicable	Requires federal agencies to evaluate the potential adverse effects associated with direct and indirect development of a floodplain. Alternatives that involve modification/construction within a floodplain may not be selected unless a determination is made that no practicable alternative exists. If no practicable alternative exists, potential harm must be minimized and action taken to restore and preserve the natural and beneficial values of the floodplain.	Contaminated soil removal will be designed to minimize alteration/destruction of the floodplain area. If this alternative is chosen, floodplains affected by Remedial Investigation will be restored to original elevations.
	Wetlands	Protection of Wetlands Executive Order 11990 [40 CFR Part 6, Appendix A]	Applicable	Under this Order, federal agencies are required to minimize the destruction, loss, or degradation of wetlands, and preserve and enhance natural and beneficial values of wetlands. If remediation is required within wetland areas, and no practical alternative exists, potential harm must be minimized and action taken to restore natural and beneficial values.	Contaminated soil removal will be designed to minimize alteration/destruction of the wetlands. If this alternative is chosen, the wetlands will be restored.
	Wetlands, Aquatic Ecosystem	Clean Water Act, Dredge or Fill Requirements Section 404 [40 CFR Part 230]	Relevant and Appropriate	Section 404 of the CWA regulates the discharge of dredged or fill materials to U.S. waters, including wetlands. Filling wetlands would be considered a discharge of fill materials. Guidelines for Specification of Disposal Sites for Dredged or Fill material at 40 CFR Part 230, promulgated under CWA Section 404(b)(1), maintain that no discharge of dredged or fill material will be permitted if there is a practical alternative that would have less effect on the aquatic ecosystem. If adverse impacts are unavoidable, action must be taken to restore, or create alternative wetlands.	The removal of soil will be designed for eventual restoration. A Massachusetts PGP (granted by USACE) is typically required prior to excavating/restoring any sediment. The substantive portions of the permit would potentially be required.
	Surface Waters, Endangered Species, Migratory Species	Fish and Wildlife Coordination Act [16 USC 661 et seq.]	Relevant and Appropriate	Actions that affect species/habitat require consultation with USDOI, USFWS, NMFS, and/or state agencies, as appropriate, to ensure that proposed actions do not jeopardize the continued existence of the species or adversely modify or destroy critical habitat. The effects of water-related projects on fish and wildlife resources must be considered. Action must be taken to	To the extent necessary, actions will be taken to develop measures to prevent, mitigate, or compensate for project related impacts to habitat and wildlife. The USFWS, acting as a review agency for the USEPA, will be kept informed of proposed Remedial Investigations.

Table 6-11
Synopsis of Federal and State Location-Specific ARARs for Alternative II-4

AOC 57Feasibility Study
Devens, MA

Regulatory Authority	Location Characteristic	Requirement	Status	Requirement Synopsis	Action To Be Taken To Attain Requirement
				prevent, mitigate, or compensate for project-related damages or losses to fish and wildlife resources. Consultation with the responsible agency is also strongly recommended for on-site actions. Under 40 CFR Part 300.38, these requirements apply to all response activities under the NCP.	
Federal (cont.)	Endangered Species	Endangered Species Act [50 CFR Parts 17.11-17.12]	Relevant and Appropriate	This act requires action to avoid jeopardizing the continued existence of listed endangered or threatened species or modification of their habitat.	According to the RI report, no endangered federally-listed species have been identified within one mile of the AOC 57. However, protection of endangered species and their habitat will be considered as part of the design and excavation activities.
	Atlantic Flyway, Wetlands, Surface Waters	Migratory Bird Treaty Act [16 USC 703 et seq.]	Relevant and Appropriate	The Migratory Bird Treaty Act protects migratory birds, their nests, and eggs. A depredation permit is required to take, possess, or transport migratory birds or disturb their nests, eggs, or young.	Remedial Investigations will be performed to protect migratory birds, their nests, and eggs.
State	Floodplains, Wetlands, Surface Waters	Massachusetts Wetland Protection Regulations [310 CMR 10.00]	Applicable	These regulations include standards on dredging, filling, altering, or polluting inland wetlands and protected areas (defined as areas within the 100-year floodplain). A NOI must be filed with the municipal conservation commission and a Final Order of Conditions obtained before proceeding with the activity. A Determination of Applicability or NOI must be filed for activities such as excavation within a 100 foot buffer zone. The regulations specifically prohibit loss of over 5,000 square feet of bordering vegetated wetland. Loss may be permitted with replication of any lost area within two growing seasons.	All work to be performed within wetlands and the 100 foot buffer zone will be in accordance with the substantive requirements of these regulations.
	Endangered Species	Massachusetts Endangered Species Regulations [321 CMR 8.00]	Applicable	Actions must be conducted in a manner that minimizes the impact to Massachusetts-listed rare, threatened, or endangered species, and species listed by the Massachusetts Natural Heritage Program.	The RI report identified several state-listed rare, threatened, or endangered species occurring within one mile of AOC 57. The protection of state listed endangered species will be considered during the design and implementation of this alternative.

Notes:

AOC	=	Area of contamination
ARAR	=	Area of Contamination
CFR	=	Code of Federal Regulations
CMR	=	Code of Massachusetts Regulations
CWA	=	Clean Water Act
USDOI	=	U.S. Department of the Interior
USFWS	=	U.S. Fish and Wildlife Service
NCP	=	National Contingency Plan
NMFS	=	National Maine Fisheries Service
NOI	=	Notice of Intent
PGP	=	Programatic General Permit
RI	=	Remedial Investigation
USACE	=	U.S. Army Corps of Engineers
USEPA	=	U.S. Environmental Protection Agency
USC	=	United States Code

TABLE 6-12
SYNOPSIS OF FEDERAL AND STATE ACTION-SPECIFIC ARARS FOR ALTERNATIVE II-4

AOC 57 FEASIBILITY STUDY
DEVENS, MA

REGULATORY AUTHORITY	ACTION	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
Federal	Control of surface water runoff, Direct discharge to surface water	Clean Water Act NPDES Permit Program [40 CFR 122,125]	Relevant and Appropriate	The NPDES permit program specifies the permissible concentration or level of contaminants in the discharge from any point source, including surface runoff, to waters of the United States.	Construction activities will be controlled to meet USEPA discharge requirements. Water collected from dewatering and stockpile activities will be collected and treated offsite or discharged to the Devens WWTP. Any on-site runoff discharges (though none expected) will meet the substantive requirements of these regulations.
	Discharge to Devens Treatment Plant	CWA, General Pretreatment Program (40 CFR Part 403)	Applicable	Discharge of nondomestic wastewater to WWTP must comply with the general prohibitions of this regulation, as well as categorical standards, and local pretreatment standards.	Discharge to Devens WWTP would be sampled to evaluate compliance with pre-treatment standards.
	Groundwater	USEPA OSWER Publication 9345.3-03FS, January 1992	To Be Considered	Management of IDW must ensure protection of human health and the environment.	IDW produced from well sampling will comply with ARARs.
	RCRA - Identification and Listing of Hazardous Wastes	Toxicity Characteristics (40 CFR 261.24)	Applicable	Defines those wastes that are subject to regulations as hazardous wastes under 40 CFR Parts 124 and 264.	Soil/sediment analytical results will be evaluated against the criteria and definitions of hazardous waste. The criteria and definition of hazardous waste will be referred to and utilized in development of the Remedial Investigation.
	Disposal of soil that contains hazardous waste	RCRA, Land Disposal Restrictions (40 CFR 268)	Applicable	Land disposal of RCRA hazardous wastes without specified treatment is restricted. LDRs require that such wastes must be treated either by a treatment technology or to a specific concentration prior to disposal in a RCRA Subtitle C permitted facility.	Waste materials from Area 2 will be evaluated to determine whether the waste is subject to LDRs. If so, the materials will be treated in accordance with LDRs prior to disposal at an off-base facility.
	Management of PCB-contaminated soil	TSCA (40 CFR Part 761 Subpart G) PCB Spill Cleanup Policy	To be considered	This policy governs the cleanup of PCB spills occurring after May 4, 1987. Because this policy isnot a regulation and only applies to recent spills (reported within 24hours of occurrence), these requirements are not applicable, but will be considered.	This policy would only be considered during the development of Remedial Investigation for areas with expected detected PCBs at concentrations greater than or equal to 50 ppm. The highest concentration of PCBs in soil was detected during the RI at 12 ppm.
	Management of PCB-contaminated soil	TSCA (40 CFR Part 761 Subpart D) Storage and Disposal	Relevant and Appropriate	This regulation governs the storage and final disposal of PCBsl. The regulation also specifies procedures to be followed in	Section 761.61 cleanup levels for low and high occupancy areas are $\leq$ 1 ppm, respectively. RI calculated RBCs for

TABLE 6-12
SYNOPSIS OF FEDERAL AND STATE ACTION-SPECIFIC ARARS FOR ALTERNATIVE II-4

AOC 57 FEASIBILITY STUDY
DEVENS, MA

REGULATORY AUTHORITY	ACTION	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
				decontaminating containers and moveable equipment used in storage areas. Section 761.61 pertains to PCB remediation wastes and provides self-implementing on-site cleanup and disposal requirements. Per Section 761.61, the self-implementing cleanup provisions are not binding for cleanups conducted under CERCLA.	Aroclor – 1260 are more conservative and will be used as PRGs at AOC 57. Off-site storage, disposal and decontamination requirements specified in this regulation will be applied for soil or sediment containing PCBs.
State	Hazardous Waste	Hazardous Waste Management Systems; (RCRA 40 CFR 260)	Relevant and Appropriate	USEPA procedures for making information available to the public; rules for claims of business confidentially.	Does not address cleanup requirements. However, these procedures will be followed when dealing with hazardous waste.
	Hazardous Waste	Standards for Owners and Operators of Hazardous Waste Treatment, Storage and Disposal Facilities (RCRA 40 CFR 264)	Relevant and Appropriate	Define requirements for RCRA facility operations and management including impoundments, wastepiles, land treatment, landfills, incinerators, storage, closure and post closure.	Operations, management and safety requirements in effect for all portions of remedial process, if hazardous waste is being handled.
	Hazardous Waste	RCRA 40 CFR Part 262, Standards Applicable to Generators of Hazardous Waste	Relevant and Appropriate	These regulations establish standards for generators of hazardous waste. RCRA Subtitle C established standards applicable to treatment, storage, and disposal of hazardous waste and closure of hazardous waste facilities.	Sediments will be tested to determine whether they contain characteristic hazardous waste. If so, management of the hazardous waste would comply with substantive requirements of these regulations.
	Hazardous Waste	Massachusetts Hazardous Waste Management Rules; 310 CMR 30.000	Relevant and Appropriate	These rules set forth Massachusetts definitions and criteria for establishing whether waste materials are hazardous and subject to associated hazardous waste regulations.	These regulations supplement RCRA requirements. Those criteria and definitions more stringent than RCRA take precedence over federal requirements.
	Activities that potentially affect surface water quality	Massachusetts Water Quality Certification and Certification for Dredging [314 CMR 9.00]	Relevant and Appropriate	A Massachusetts Division of Water Pollution Control Water Quality Certification is required pursuant to 314 CMR 9.00 for dredging-related activities in waters (including wetlands) within the Commonwealth which require federal licenses or permits and which are subject to state water quality certification.	Excavation and filling activities will meet the substantive criteria and standards of these regulations. Remedial activities will be designed to attain and maintain Massachusetts Water Quality Standards in affected waters.
	Activities that affect ambient air quality	Massachusetts Air Pollution Control Regulations [310 CMR 7.00]	Applicable	These regulations pertain to the prevention of emissions in excess of Massachusetts ambient air quality standards.	Remedial activities will be conducted to meet the standards for Visible Emissions (310 CMR 7.06); Dust, Odor, Construction and Demolition (310 CMR 7.09); Noise (310 CMR 7.10); and Volatile Organic Compounds (310 CMR 7.18).

Notes:

ARARs	=	Applicable or Relevant and Appropriate Requirements
CFR	=	Code of Federal Regulations
CMR	=	Code of Massachusetts Regulations
CWA	=	Clean Water Act
IDW	=	Investigation derived waste
LDR	=	Land Disposal Restrictions
NPDES	=	National Pollutant Discharge Elimination System
RCBs	=	Risk-based concentrations
RCRA	=	Resource Conservation and Recovery Act
RI	=	Remedial Investigation
TSCA	=	Toxic Substances Control Act
PCB	=	Polychlorinated biphenyls
PRGs	=	preliminary remediation goals
USEPA	=	U.S. Environmental Protection Agency
WWTP	=	Wastewater Treatment Plant

TABLE 6-13
SYNOPSIS OF FEDERAL AND STATE CHEMICAL-SPECIFIC ARARS FOR ALTERNATIVE III-1 (NO ACTION)

AOC 57 FEASIBILITY STUDY
DEVENS, MA

REGULATORY AUTHORITY	CHEMICAL MEDIUM	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
Federal	Groundwater	Safe Drinking Water Act, National Primary Drinking Water Regulations, MCLs and MCLGs [40 CFR Parts 141.60 - 141.63 and 141.50 - 141.52]	Relevant and Appropriate	The National Primary Drinking Water Regulations establish MCLs and MCLGs for several common organic and inorganic contaminants. MCLs specify the maximum permissible concentrations of contaminants in public drinking water supplies. MCLs are federally enforceable standards based in part on the availability and cost of treatment techniques. MCLGs specify the maximum concentration at which no known or anticipated adverse effect on humans will occur. MCLGs are non-enforceable health based goals set equal to or lower than MCLs.	The MCLs for arsenic, cadmium, PCE, and 1,4-dichlorobenzene will likely be met through natural attenuation processes. However, monitoring would not be performed to measure changes in contaminant concentrations or migration; therefore attainment of groundwater ARARs would not be confirmed at the two locations (57M-95-03X and 57M-96-11X), where MCL exceedances were detected.
State	Groundwater	Massachusetts Groundwater Quality Standards [314 CMR 6.00]	Relevant and Appropriate	These standards designate and assign uses for which groundwaters of the Commonwealth shall be maintained and protected, and set forth water quality criteria necessary to maintain the designated uses. Groundwater at Fort Devens is classified as Class I, fresh groundwaters designated as a source of potable water supply.	The concentrations of arsenic, cadmium, PCE, and 1,4-dichlorobenzene will likely achieve MMCLs through natural attenuation processes. However, monitoring would not be performed to measure changes in contaminant concentrations or migration; therefore attainment of groundwater MMCLs would not be confirmed at the two locations (57M-95-03X and 57M-96-11X).
	Groundwater	Massachusetts Drinking Water Regulations [310 CMR 22.00]	Relevant and Appropriate	These regulations list MMCLs which apply to drinking water distributed through a public water system.	As previously stated, Devens groundwater is classified as Class 1, and designated as a source of potable water supply. However, no environmental monitoring program would be established under this alternative to indicate that MMCLs have been achieved. AOC 57 is currently not within a Zone I or II/Interim Wellhead Protection Area. Because Devens has a municipal water supply, any future construction at AOC 57 would be supplied with municipal water.

Notes:
AOC = Area of contamination
ARARs = Applicable or Relevant and Appropriate Requirements
CFR = Code of Federal Regulations
CMR = Code of Massachusetts Rules
MCL = Maximum Contaminant Level
MCLG = Maximum Contaminant Level Goal
MMCL = Massachusetts Maximum Contaminant Level
PCE = Tetrachloroethylene

TABLE 6-14
SYNOPSIS OF FEDERAL AND STATE LOCATION-SPECIFIC ARARS FOR ALTERNATIVE III-1 (NO ACTION)

AOC 57 FEASIBILITY STUDY
DEVENS, MA

REGULATORY AUTHORITY	LOCATION CHARACTERISTIC	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
Federal/State	No location-specific ARARs are triggered.				

Notes:

ARARs = Applicable or Relevant and Appropriate Requirements

TABLE 6-15
SYNOPSIS OF FEDERAL AND STATE ACTION-SPECIFIC ARARS FOR ALTERNATIVE III-1 (NO ACTION)

AOC 57 FEASIBILITY STUDY
DEVENS, MA

REGULATORY AUTHORITY	ACTION	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
Federal/State	No action-specific ARARs are triggered.				

Notes:

ARARs = Applicable or Relevant and Appropriate Requirements

TABLE 6-16
SYNOPSIS OF FEDERAL AND STATE CHEMICAL-SPECIFIC ARARS FOR ALTERNATIVES III-2 (LIMITED ACTION)

AOC 57 FEASIBILITY STUDY
DEVENS, MA

REGULATORY AUTHORITY	CHEMICAL MEDIUM	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
Federal	Groundwater	Safe Drinking Water Act, National Primary Drinking Water Regulations, MCLs and MCLGs [40 CFR Parts 141.60 - 141.63 and 141.50 - 141.52]	Relevant and Appropriate	The National Primary Drinking Water Regulations establish Maximum Contaminant Levels (MCLs) and Maximum Contaminant Level Goals (MCLGs) for several common organic and inorganic contaminants. MCLs specify the maximum permissible concentrations of contaminants in public drinking water supplies. MCLs are federally enforceable standards based in part on the availability and cost of treatment techniques. MCLGs specify the maximum concentration at which no known or anticipated adverse effect on humans will occur. MCLGs are non-enforceable health based goals set equal to or lower than MCLs.	The MCLs for arsenic, cadmium, PCE, and 1,4-dichlorobenzene will likely be met through natural attenuation processes. Monitoring would be performed to measure changes in contaminant concentrations or migration; therefore attainment of groundwater ARARs would eventually be confirmed at the two locations (57M-95-03X and 57M-96-11X), where MCL exceedances were detected.
State	Groundwater	Massachusetts Groundwater Quality Standards [314 CMR 6.00]	Relevant and Appropriate	These standards designate and assign uses for which groundwaters of the commonwealth shall be maintained and protected, and set forth water quality criteria necessary to maintain the designated uses. Groundwater at Fort Devens is classified as Class I, fresh groundwaters designated as a source of potable water supply.	314 CMR 6.00 would be met by achieving MMSLs for arsenic, cadmium, PCE, and 1,4-dichlorobenzene. The MMCLs will likely be met through natural attenuation processes. Monitoring would be performed to measure changes in contaminant concentrations or migration; therefore attainment of groundwater MMCLs would eventually be confirmed at the two locations (57M-95-03X and 57M-96-11X).
	Groundwater	Massachusetts Drinking Water Regulations [310 CMR 22.00]	Relevant and Appropriate	These regulations list Massachusetts MCLs which apply to drinking water distributed through a public water system.	As previously stated, Devens groundwater is classified as Class1, and designated as a source of potable water supply. AOC 57 is currently not within a Zone I or II/Interim Wellhead Protection Area. An AUL would be established at Area 3 until the environmental monitoring program indicates that MMCLs have been achieved for at least three years.

Notes:

AOCs	=	Area of Contamination
ARARs	=	Applicable or Relevant and Appropriate Requirements
CFR	=	Code of Federal Regulations
CMR	=	Code of Massachusetts Rules
MCL	=	Maximum Contaminant Level
MCLG	=	Maximum Contaminant Level Goal
MMCL	=	Massachusetts Maximum Contaminant

Table 6-17
Synopsis of Federal and State LOCATION-Specific ARARs For Alternative III-2 (Limited Action)

AOC 57 Feasibility Study
Devens, MA

Regulatory Authority	Location Characteristic	Requirement	Status	Requirement Synopsis	Action To Be Taken To Attain Requirement
Federal/State	No location-specific ARARs are triggered.				

Notes:

ARARs = Applicable or Relevant and Appropriate Requirements

TABLE 6-18
SYNOPSIS OF FEDERAL AND STATE ACTION-SPECIFIC ARARS FOR ALTERNATIVES III-2 (LIMITED ACTION)

AOC 57 FEASIBILITY STUDY
DEVENS, MA

REGULATORY AUTHORITY	ACTION	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
Federal	Groundwater	USEPA OSWER Publication 9345.3-03FS, January 1992	To Be Considered	Management of IDW must ensure protection of human health and the environment.	IDW produced from well sampling will comply with ARARs.

Notes:

ARARs = Applicable or Relevant and Appropriate Requirements
IDW = Investigation-derived waste
USEPA = U.S. Environmental Protection Agency

TABLE 6-19
SYNOPSIS OF FEDERAL AND STATE CHEMICAL-SPECIFIC ARARS FOR ALTERNATIVES III-3

AOC 57 FEASIBILITY STUDY
DEVENS, MA

REGULATORY AUTHORITY	CHEMICAL MEDIUM	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
Federal	Groundwater	Safe Drinking Water Act, National Primary Drinking Water Regulations, MCLs and MCLGs [40 CFR Parts 141.60 - 141.63 and 141.50 - 141.52]	Relevant and Appropriate	The National Primary Drinking Water Regulations establish Maximum Contaminant Levels (MCLs) and Maximum Contaminant Level Goals (MCLGs) for several common organic and inorganic contaminants. MCLs specify the maximum permissible concentrations of contaminants in public drinking water supplies. MCLs are federally enforceable standards based in part on the availability and cost of treatment techniques. MCLGs specify the maximum concentration at which no known or anticipated adverse effect on humans will occur. MCLGs are non-enforceable health based goals set equal to or lower than MCLs.	The MCLs for arsenic, cadmium, PCE, and 1,4-dichlorobenzene will likely be met through natural attenuation processes. Monitoring would be performed to measure changes in contaminant concentrations or migration; therefore attainment of groundwater ARARs would eventually be confirmed at the two locations (57M-95-03X and 57M-96-11X), where MCL exceedances were detected.
State	Groundwater	Massachusetts Groundwater Quality Standards [314 CMR 6.00]	Relevant and Appropriate	These standards designate and assign uses for which groundwaters of the commonwealth shall be maintained and protected, and set forth water quality criteria necessary to maintain the designated uses. Groundwater at Fort Devens is classified as Class I, fresh groundwaters designated as a source of potable water supply.	314 CMR 6.00 would be met by achieving MMSLs for arsenic, cadmium, PCE, and 1,4-dichlorobenzene. The MMCLs will likely be met through natural attenuation processes. Monitoring would be performed to measure changes in contaminant concentrations or migration; therefore attainment of groundwater MMCLs would eventually be confirmed at the two locations (57M-95-03X and 57M-96-11X).
	Groundwater	Massachusetts Drinking Water Regulations [310 CMR 22.00]	Relevant and Appropriate	These regulations list Massachusetts MCLs which apply to drinking water distributed through a public water system.	As previously stated, Devens groundwater is classified as Class1, and designated as a source of potable water supply. AOC 57 is currently not within a Zone I or II/Interim Wellhead Protection Area. An AUL would be established at Area 3 until the environmental monitoring program indicates that MMCLs have been achieved for at least three years.

Notes:

AOCs	=	Area of Contamination
ARARs	=	Applicable or Relevant and Appropriate Requirements
CFR	=	Code of Federal Regulations
CMR	=	Code of Massachusetts Rules
MCL	=	Maximum Contaminant Level
MCLG	=	Maximum Contaminant Level Goal
MMCL	=	Massachusetts Maximum Contaminant Level

TABLE 6-20
SYNOPSIS OF FEDERAL AND STATE LOCATION-SPECIFIC ARARS FOR ALTERNATIVE III-3

AOC 57FEASIBILITY STUDY
DEVENS, MA

REGULATORY AUTHORITY	LOCATION CHARACTERISTIC	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
Federal	Floodplains	Floodplain Management Executive Order 11988 [40 CFR Part 6, Appendix A]	Applicable	Requires federal agencies to evaluate the potential adverse effects associated with direct and indirect development of a floodplain. Alternatives that involve modification/construction within a floodplain may not be selected unless a determination is made that no practicable alternative exists. If no practicable alternative exists, potential harm must be minimized and action taken to restore and preserve the natural and beneficial values of the floodplain.	Contaminated soil removal will be designed to minimize alteration/destruction of the floodplain area. If this alternative is chosen, floodplains affected by Remedial Investigation will be restored to original elevations.
	Wetlands	Protection of Wetlands Executive Order 11990 [40 CFR Part 6, Appendix A]	Applicable	Under this Order, federal agencies are required to minimize the destruction, loss, or degradation of wetlands, and preserve and enhance natural and beneficial values of wetlands. If remediation is required within wetland areas, and no practical alternative exists, potential harm must be minimized and action taken to restore natural and beneficial values.	Contaminated soil removal will be designed to minimize alteration/destruction of the wetlands. If this alternative is chosen, the wetlands will be restored.
	Wetlands, Aquatic Ecosystem	Clean Water Act, Dredge or Fill Requirements Section 404 [40 CFR Part 230]	Relevant and Appropriate	Section 404 of the CWA regulates the discharge of dredged or fill materials to U.S. waters, including wetlands. Filling wetlands would be considered a discharge of fill materials. Guidelines for Specification of Disposal Sites for Dredged or Fill material at 40 CFR Part 230, promulgated under CWA Section 404(b)(1), maintain that no discharge of dredged or fill material will be permitted if there is a practical alternative that would have less effect on the aquatic ecosystem. If adverse impacts are unavoidable, action must be taken to restore, or create alternative wetlands.	The removal of soil will be designed for eventual restoration. A Massachusetts PGP (granted by USACE) is typically required prior to excavating/restoring any sediment. The substantive portions of the permit would potentially be required.
	Surface Waters, Endangered Species, Migratory Species	Fish and Wildlife Coordination Act [16 USC 661 et seq.]	Relevant and Appropriate	Actions that affect species/habitat require consultation with USDOI, USFWS, NMFS, and/or state agencies, as appropriate, to ensure that proposed actions do not jeopardize the continued existence of the species or adversely modify or destroy critical habitat. The effects of water-related projects on fish and wildlife resources must be considered. Action must be taken to prevent, mitigate, or compensate for project-related damages or losses to fish and wildlife resources. Consultation with the responsible agency is	To the extent necessary, actions will be taken to develop measures to prevent, mitigate, or compensate for project related impacts to habitat and wildlife. The USFWS, acting as a review agency for the USEPA, will be kept informed of proposed Remedial Investigations.

TABLE 6-20
SYNOPSIS OF FEDERAL AND STATE LOCATION-SPECIFIC ARARS FOR ALTERNATIVE III-3

AOC 57FEASIBILITY STUDY
DEVENS, MA

REGULATORY AUTHORITY	LOCATION CHARACTERISTIC	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
				also strongly recommended for on-site actions. Under 40 CFR Part 300.38, these requirements apply to all response activities under the NCP.	
	Endangered Species	Endangered Species Act [50 CFR Parts 17.11-17.12]	Relevant and Appropriate	This act requires action to avoid jeopardizing the continued existence of listed endangered or threatened species or modification of their habitat.	According to the RI report, no endangered federally-listed species have been identified within one mile of the AOC 57. However, protection of endangered species and their habitat will be considered as part of the design and excavation activities.
	Atlantic Flyway, Wetlands, Surface Waters	Migratory Bird Treaty Act [16 USC 703 et seq.]	Relevant and Appropriate	The Migratory Bird Treaty Act protects migratory birds, their nests, and eggs. A depredation permit is required to take, possess, or transport migratory birds or disturb their nests, eggs, or young.	Remedial Investigations will be performed to protect migratory birds, their nests, and eggs.
State	Floodplains, Wetlands, Surface Waters	Massachusetts Wetland Protection Regulations [310 CMR 10.00]	Applicable	These regulations include standards on dredging, filling, altering, or polluting inland wetlands and protected areas (defined as areas within the 100-year floodplain). A NOI must be filed with the municipal conservation commission and a Final Order of Conditions obtained before proceeding with the activity. A Determination of Applicability or NOI must be filed for activities such as excavation within a 100 foot buffer zone. The regulations specifically prohibit loss of over 5,000 square feet of bordering vegetated wetland. Loss may be permitted with replication of any lost area within two growing seasons.	All work to be performed within wetlands and the 100 foot buffer zone will be in accordance with the substantive requirements of these regulations.
	Endangered Species	Massachusetts Endangered Species Regulations [321 CMR 8.00]	Applicable	Actions must be conducted in a manner that minimizes the impact to Massachusetts-listed rare, threatened, or endangered species, and species listed by the Massachusetts Natural Heritage Program.	The RI report identified several state-listed rare, threatened, or endangered species occurring within one mile of AOC 57. The protection of state listed endangered species will be considered during the design and implementation of this alternative.

Notes:

AOC	=	Area of contamination
ARAR	=	Area of Contamination
CFR	=	Code of Federal Regulations
CMR	=	Code of Massachusetts Regulations
CWA	=	Clean Water Act
USDOI	=	U.S. Department of the Interior
USFWS	=	U.S. Fish and Wildlife Service
NCP	=	National Contingency Plan
NMFS	=	National Maine Fisheries Service
NOI	=	Notice of Intent
PGP	=	Programatic General Permit
RI	=	Remedial Investigation
USACE	=	U.S. Army Corps of Engineers
USEPA	=	U.S. Environmental Protection Agency
USC	=	United States Code

TABLE 6-21
SYNOPSIS OF FEDERAL AND STATE ACTION-SPECIFIC ARARs FOR ALTERNATIVE III-3

AOC 57 FEASIBILITY STUDY
DEVENS, MA

REGULATORY AUTHORITY	ACTION	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
Federal	Control of surface water runoff, Direct discharge to surface water	Clean Water Act NPDES Permit Program [40 CFR 122,125]	Relevant and Appropriate	The National Pollutant Discharge Elimination System (NPDES) permit program specifies the permissible concentration or level of contaminants in the discharge from any point source, including surface runoff, to waters of the United States.	Construction activities will be controlled to meet USEPA discharge requirements. Water collected from dewatering and stockpile activities will be collected and treated offsite or discharged to Devens WWTP. Any on-site runoff discharges (though none expected) will meet the substantive requirements of these regulations.
	Discharge to Devens Treatment Plant	CWA, General Pretreatment Program (40 CFR Part 403)	Applicable	Discharge of nondomestic wastewater to WWTP must comply with the general prohibitions of this regulation, as well as categorical standards, and local pretreatment standards.	Discharge to Devens WWTP would be sampled to evaluate compliance with pre-treatment standards.
	Groundwater	USEPA OSWER Publicaton 9345.3-03FS, January 1992	To Be Considered	Management of IDW must ensure protection of human health and the environment.	IDW produced from well sampling will comply with ARARs.
	RCRA – Identification and Listing of Hazardous Wastes	Toxicity Characteristics (40 CFR 261.24)	Applicable	Defines those wastes that are subject to regulations as hazardous wastes under 40 CFR Parts 124 and 264.	Soil/sediment analytical results will be evaluated against the criteria and definitions of hazardous waste. The criteria and definition of hazardous waste will be referred to and utilized in development of the remedial action.
	Disposal of soil that contains hazardous waste	RCRA, Land Disposal Restrictions (40 CFR 268)	Applicable	Land disposal of RCRA hazardous wastes without specified treatment is restricted. LDRs require that such wastes must be treated either by a treatment technology or to a specific concentration prior to disposal in a RCRA Subtitle C permitted facility.	Waste materials from Area 3 will be evaluated to determine whether the waste is subject to LDRs. If so, the materials will not be disposed of on base but will be treated in accordance with LDRs prior to disposal at an off-base facility.
	Hazardous Waste	Hazardous Waste Management Systems; (RCRA 40 CFR 260)	Relevant and Appropriate	USEPA procedures for making information available to the public; rules for claims of business confidentially.	Does not address cleanup requirements. However, these procedures will be followed when dealing with hazardous waste.
	Hazardous Waste	Standards for Owners and Operators of Hazardous Waste Treatment, Storage and Disposal Facilities (RCRA 40 CFR 264)	Relevant and Appropriate	Define requirements for RCRA facility operations and management including impoundments, wastepiles, land treatment, landfills, incinerators, storage, closure and post closure.	Operations, management and safety requirements in effect for all portions of remedial process, if hazardous waste is being handled.
	Hazardous Waste	RCRA 40 CFR Part 262, Standards Applicable to Generators of Hazardous Waste	Relevant and Appropriate	RCRA Subtitle C established standards applicable to treatment, storage, and disposal of hazardous waste and closure of hazardous waste facilities.	Sediments will be tested to determine whether they contain characteristic hazardous waste. If so, treatment on-site would comply with substantive requirements of these regulations.
State	Hazardous Waste	Massachusetts Hazardous Waste Management Rules; 310 CMR 30.000	Relevant and Appropriate	These rules set forth Massachusetts definitions and criteria for establishing whether waste materials are hazardous and subject to associated hazardous waste regulations.	These regulations supplement RCRA requirements. Those criteria and definitions more stringent than RCRA take precedence over federal requirements.

Table 6-21
Synopsis of Federal and State Action-Specific ARARs for Alternative III-3

AOC 57 Feasibility Study
Devens, MA

Regulatory Authority	Action	Requirement	Status	Requirement Synopsis	Action To Be Taken To Attain Requirement
State (cont.)	Activities that potentially affect surface water quality	Massachusetts Water Quality Certification and Certification for Dredging [314 CMR 9.00]	Relevant and Appropriate	A Massachusetts Division of Water Pollution Control Water Quality Certification is required pursuant to 314 CMR 9.00 for dredging-related activities in waters (including wetlands) within the Commonwealth which require federal licenses or permits and which are subject to state water quality certification.	Excavation and filling activities will meet the substantive criteria and standards of these regulations. Remedial activities will be designed to attain and maintain Massachusetts Water Quality Standards in affected waters.
	Activities that affect ambient air quality	Massachusetts Air Pollution Control Regulations [310 CMR 7.00]	Applicable	These regulations pertain to the prevention of emissions in excess of Massachusetts ambient air quality standards.	Remedial activities will be conducted to meet the standards for Visible Emissions (310 CMR 7.06); Dust, Odor, Construction and Demolition (310 CMR 7.09); Noise (310 CMR 7.10); and Volatile Organic Compounds (310 CMR 7.18).

Notes:

ARARs = Applicable or Relevant and Appropriate Requirements
CFR = Code of Federal Regulations
CMR = Code of Massachusetts Regulations
CWA = Clean Water Act
IDW = Investigation-derived waste
LDR = Land Disposal Restrictions
NPDES = National Pollutant Discharge Elimination System
PCB = Polychlorinated biphenyls
PRGs = preliminary remediation goals
RBCs = Risk-based concentrations
RCRA = Resource Conservation and Recovery Act
RI = Remedial Investigation
TSCA = Toxic Substances Control Act
USEPA = U.S. Environmental Protection Agency
WWTP = Wastewater Treatment Plant

Table 6-22
Area 2 Wetlands
Alternative II-2: Limited Action Alternative (Institutional Controls)
Cost Summary Table

AOC 57
Focused Feasibility Study
Devens, MA

ITEM	COST
DIRECT COSTS	
Boundary Survey, Institutional Controls	$14,500
Direct Subtotal	$14,500
INDIRECT COSTS	
Survey Oversight	$750
Legal/Administrative Fees	$1,000
Indirect Subtotal	$1,750
TOTAL CAPITAL COSTS	$16,250
OPERATION AND MAINTENANCE COSTS	
Present Worth of GW/SW Sampling 2X's/yr for 3 yrs @7%	$43,412
Present Worth of GW/SW Sampling 1X/yr for yrs 4..30 @7%	$80,931
Present Worth of Institutional Control Inspections for 30 years @ 7%	$13,402
Present Worth of Institut. Control Reviews (every 5 yrs for 30 years @	$41,169
TOTAL O&M COSTS	$178,914
TOTAL CAPITAL AND O&M COSTS	$195,164
UNSPECIFIED DESIGN DETAILS (@25 PERCENT)	$48,791
TOTAL PRESENT WORTH OF ALTERNATIVE II-2	$243,955

COST SENSITIVITY ANALYSIS - MINIMUM ESTIMATE

Assume capital costs will remain the same and IC.site reviews will remain at 30 years.
Assume groundwater will attain MCLs after one year. Add two extra years validation for a total of 3 years monitoring.

MINIMUM COST OF LIMITED ACTION ALTERNATIVE - AREA 2	$142,791

Note: See detailed cost analysis (Appendix B).

Table 6-23
Area 2 Wetlands
Alternative II-3: Excavation (for Possible Future Use) and Institutional Controls
Cost Summary Table

AOC 57
Focused Feasibility Study
Devens, MA

ITEM	COST
DIRECT COSTS	
Pre-Design Investigation (2 days drilling/soil collection; analyses)	$5,670
Setup, Excavation, Dewatering, Transport, Disposal, Restoration	$211,475
Confirmatory Sampling, Summary Data Report	$12,879
Waste Characterization	$19,280
Wetland Delineation, Boundary Survey, Institutional Controls	$16,000
Direct Subtotal	$265,304
INDIRECT COSTS	
Design/Permitting (@10% of direct cost)	$26,530
Wetland Restoration Plan, Health&Safety	$14,765
Pre-Construction Mtg, Construction Oversight (@5% of direct cost)	$28,780
Legal/Administrative Fees (@5% of direct cost)	$13,265
Indirect Subtotal	$83,341
TOTAL CAPITAL COSTS	$348,645
OPERATION AND MAINTENANCE COSTS	
Present Worth of GW/SW Sampling 2X's/yr for 3 yrs @7%	$43,412
Present Worth of GW/SW Sampling 1X/yr for yrs 4..30 @7%	$80,931
Present Worth of Wetland Restoration Monitoring for 5 yrs @ 7%	$6,150
Present Worth of Institutional Control Inspections for 30 years @ 7%	$13,402
Present Worth of Institut. Control Reviews (every 5 yrs for 30 years @	$41,169
TOTAL O&M COSTS	$185,064
TOTAL CAPITAL AND O&M COSTS	$533,709
UNSPECIFIED DESIGN DETAILS (@25 PERCENT)	$133,427
TOTAL PRESENT WORTH OF ALTERNATIVE II-3	$667,137
COST SENSITIVITY ANALYSIS - MINIMUM ESTIMATE Also assume that the soil requiring excavation is reduced by 25% (160 CY, 288 tons, or 1 foot). Assume groundwater will attain MCLs after one year. Add two extra years validation for a total of 3 years monitoring. Assume wetland monitoring will remain at 5 years and IC/site reviews will remain at 30 years.	
MINIMUM COST OF POSSIBLE FUTURE USE ALTERNATIVE - AREA 2	$514,521
COST SENSITIVITY ANALYSIS - MAXIMUM ESTIMATE Assume that the soil requiring excavation is increased by 25% (160 CY, 288 tons, or 1 foot).	
MAXIMUM COST OF POSSIBLE FUTURE USE ALTERNATIVE - AREA 2	$718,585

Note: See detailed cost analysis (Appendix B).

Table 6-24
Area 2 Wetlands
Alternative II-4: Excavation (for Unrestricted Use) and Institutional Controls
Cost Summary Table

AOC 57
Focused Feasibility Study
Devens, MA

ITEM	COST
DIRECT COSTS	
Pre-Design Investigation (2 days drilling/soil collection; analyses)	$12,124
Setup, Excavation, Dewatering, Transport, Disposal, Restoration	$565,676
Confirmatory Sampling, Summary Data Report	$30,614
Waste Characterization	$43,380
Wetland Delineation, Boundary Survey, Institutional Controls	$16,000
Direct Subtotal	$667,794
INDIRECT COSTS	
Design/Permitting (@10% of direct cost)	$66,779
Wetland Restoration Plan, Health&Safety (@5% of direct cost)	$34,890
Pre-Construction Mtg, Construction Oversight (@5% of direct cost)	$69,029
Legal/Administrative Fees (@5% of direct cost)	$33,390
Indirect Subtotal	$204,088
TOTAL CAPITAL COSTS	$871,882
OPERATION AND MAINTENANCE COSTS	
Present Worth of GW/SW Sampling 2X's/yr for 3 yrs @7%	$43,412
Present Worth of GW/SW Sampling 1X/yr for yrs 4..30 @7%	$80,931
Present Worth of Wetland Restoration Monitoring for 5 yrs @ 7%	$6,150
Present Worth of Institutional Control Inspections for 30 years @ 7%	$13,402
Present Worth of Institut. Control Reviews (every 5 yrs for 30 years @	$41,169
TOTAL O&M COSTS	$185,064
TOTAL CAPITAL AND O&M COSTS	$1,056,946
UNSPECIFIED DESIGN DETAILS (@25 PERCENT)	$264,237
TOTAL PRESENT WORTH OF ALTERNATIVE II-4	$1,321,183
COST SENSITIVITY ANALYSIS - MINIMUM ESTIMATE	
Assume that the soil requiring excavation is reduced by 25% (450 CY, 810 tons, or 1 foot).	
Assume groundwater will attain MCLs after one year. Add two extra years validation for a total of 3 years monitoring.	
Assume wetlands monitoring and site review will be 5 years and institutional controls will cease after 3 years.	
MINIMUM COST OF UNRESTRICTED USED ALTERNATIVE - AREA 2	$1,027,664
COST SENSITIVITY ANALYSIS - MAXIMUM ESTIMATE	
Assume that the soil requiring excavation is increased by 25% (450 CY, 810 tons, or 1 foot).	
MAXIMUM COST OF UNRESTRICTED USED ALTERNATIVE - AREA 2	$1,465,870

Note: See detailed cost analysis (Appendix B).

Table 6-25
Area 3 Uplands and Wetlands
Alternative III-2: Limited Action Alternative (Institutional Controls)
Cost Summary Table

AOC 57
Focused Feasibility Study
Devens, MA

ITEM	COST
DIRECT COSTS	
Boundary Survey, Institutional Controls	$14,000
Direct Subtotal	$14,000
INDIRECT COSTS	
Survey Oversight	$750
Legal/Administrative Fees	$1,000
Indirect Subtotal	$1,750
TOTAL CAPITAL COSTS	$15,750
OPERATION AND MAINTENANCE COSTS	
Present Worth of GW/SW Sampling 2X's/yr for 3 yrs @7%	$58,794
Present Worth of GW/SW Sampling 1X/yr for yrs 4..30 @7%	$109,607
Present Worth of Institutional Control Inspections for 30 years @ 7%	$13,402
Present Worth of Institut. Control Reviews (every 5 yrs for 30 years @	$41,169
TOTAL O&M COSTS	$222,972
TOTAL CAPITAL AND O&M COSTS	$238,722
UNSPECIFIED DESIGN DETAILS (@25 PERCENT)	$59,681
TOTAL PRESENT WORTH OF ALTERNATIVE III-2	$298,403
COST SENSITIVITY ANALYSIS - MINIMUM ESTIMATE	
Assume capital costs will remain the same. Assume IC/site reviews will remain at 30 years.	
Assume groundwater will attain MCLs after 5 years. Add two extra years validation for a total of 7 years monitoring.	
MINIMUM COST OF LIMITED ACTION ALTERNATIVE - AREA 3	$200,110

Note: See detailed cost analysis (Appendix B).

Table 6-26
Area 3 Uplands and Wetlands
Alternative III-3: Excavation (for Unrestricted Use) and Institutional Controls
Cost Summary Table

AOC 57
Focused Feasibility Study
Devens, MA

ITEM	COST
DIRECT COSTS	
Setup, Excavation, Dewatering, Transport, Disposal, Restoration	$33,015
Confirmatory Sampling, Summary Data Report	$7,472
Waste Characterization	$4,820
Wetland Delineation, Boundary Survey, Institutional Controls	$14,750
Direct Subtotal	$60,057
INDIRECT COSTS	
Design/Permitting (@10% of direct cost)	$6,006
Wetland Restoration Plan, Health&Safety (@5% of direct cost)	$3,753
Pre-Construction Mtg, Construction Oversight (@5% of direct cost)	$7,881
Legal/Administrative Fees (@5% of direct cost)	$3,003
Indirect Subtotal	$20,642
TOTAL CAPITAL COSTS	$80,699
OPERATION AND MAINTENANCE COSTS	
Present Worth of GW/SW Sampling 2X's/yr for 3 yrs @7%	$58,794
Present Worth of GW/SW Sampling 1X/yr for yrs 4..30 @7%	$109,607
Present Worth of Wetland Restoration Monitoring for 5 yrs @ 7%	$6,150
Present Worth of Institutional Control Inspections for 30 years @ 7%	$13,402
Present Worth of Institut. Control Reviews (every 5 yrs for 30 years @	$41,169
TOTAL O&M COSTS	$229,122
TOTAL CAPITAL AND O&M COSTS	$309,821
UNSPECIFIED DESIGN DETAILS (@25 PERCENT)	$77,455
TOTAL PRESENT WORTH OF ALTERNATIVE III-3	$387,276
COST SENSITIVITY ANALYSIS - MINIMUM ESTIMATE	
Assume that the soil requiring excavation is reduced by 33% (40 CY, 72 tons, or 1 foot).	
Assume groundwater will attain MCLs after 5 years. Add two extra years validation for a total of 7 years monitoring.	
Assume wetlands monitoring will remain at 5 years and institutional controls will cease after 7 years.	
MINIMUM COST OF UNRESTRICTED USED ALTERNATIVE - AREA 3	$252,103
COST SENSITIVITY ANALYSIS - MAXIMUM ESTIMATE	
Assume that the soil requiring excavation is increased by 33% (40 CY, 72 tons, or 1 foot).	
MAXIMUM COST OF UNRESTRICTED USED ALTERNATIVE - AREA 3	$395,077

Note: See detailed cost analysis (Appendix B).

TABLE 7-1
COMPARATIVE ANALYSIS OF ALTERNATIVES
AREA 2 WETLAND
AOC 57

FOCUSED FEASIBILITY STUDY
DEVENS, MASSACHUSETTS

	THRESHOLD CRITERIA		BALANCING CRITERIA				
ALTERNATIVE	OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT	COMPLIANCE WITH ARARs	LONG-TERM EFFECTIVENESS AND PERMANENCE	REDUCTION OF TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT	SHORT-TERM EFFECTIVENESS	IMPLEMENTABILITY	COSTS
No. II-1: No Action	· Not protective of human health for possible future-use and unrestricted-use exposure scenarios to soil and groundwater.	· Chemical-specific ARAR concentrations are currently exceeded at only two monitoring wells. · No monitoring is performed to verify attainment of ARARs by natural attenuation processes or to assess for COC migration. · Location- and action-specific ARARs are not triggered.	· No controls implemented to reduce COC concentrations or minimize exposure to COCs in soil. · Risk reduction in groundwater likely will occur through natural attenuation processes but effectiveness and permanence are not assessed.	· Does not employ active removal or treatment processes to address soil or groundwater contamination.	· Potential risk from soil exposure at the site would exist indefinitely should construction work or residential development be permitted in the Area 2 wetland. · No action; therefore no risk to remedial workers or the environment.	· No action to implement. Inability to monitor COCs may present administrative and public acceptance obstacles.	$0
No. II-2: Limited Action	· Protective of human health by implementing Zoning and deed restrictions that prohibit possible future-use and unrestricted use exposure to wetland soil and groundwater.	· Chemical-specific ARAR concentrations currently exceeded in only two monitoring wells. Former soil removal action has reduced contamination source. Eventual reduction of COCs to meet chemical-specific ARARs in groundwater will be achieved through natural attenuation processes. · Monitoring performed to verify attainment of ARARs. · No location- and action-specific ARARs triggered.	· Zoning and deed restrictions are implemented to prohibit possible future-use and unrestricted use exposure to wetland soil and groundwater. Long-term maintenance of these controls essential for long-term effectiveness. · Acceptable risk eventually achieved in groundwater by natural attenuation processes that permanently reduce COCs to PRGs. · Reduction of COC concentrations to PRGs in groundwater confirmed by environmental monitoring. · No long-term controls of groundwater required once PRGs are achieved.	· Does not employ active removal or treatment processes to address soil contamination. · Eventual reduction of toxicity and volume of COCs will occur through natural attenuation processes in groundwater. Monitoring of COCs is performed to document reduction.	· Deed and land-use restrictions can be implemented within 2 to 6 months but would be enforced indefinitely to minimize soil exposure. · Groundwater-use restrictions protect receptors until natural attenuation processes reduce COCs below PRGs. · No increased exposure to community occurs from implementation because there are no active or intrusive remedial actions performed. HASP is protective of on-site workers (environmental sampling).	· Uses basic monitoring practices. · Deed and land-use restrictions are easily implemented considering that AOC 57wetland area is slated for recreation/open space.	30-Year NPW: $244,000
No. II-3: Excavation (for Possible Future Use) and Institutional Controls	· Protective of possible future-use exposure by excavating wetland soil with COCs exceeding risk-based PRGs and treating/disposing offsite. · Protective of unrestricted-use exposures to wetalnd soil and groundwater by enforcing zoning and deed restrictions.	· Same as Alternative II-2 except that location- and action specific ARARs pertaining to wetlands and endangered species protection, surface water runoff control, WWTP pretreatment requirements, and management of solid and hazardous wastes would also be complied with for the soil removal component.	· Similar to Alternative II-2 except that soils containing COCs exceeding possible future-use PRGs are excavated to permanently minimizes risk to the construction worker receptor. · Zoning and deed restrictions are implemented only to prohibit residential exposure to wetland soil and groundwater.	· Employs soil removal and off-site treatment /disposal to reduce toxicity and volume of COCs in soil. · Reduction of toxicity and volume of COCs in groundwater and groundwater monitoring will occur as discussed in Alternative II-2. · Satisfies the statutory preference for treatment under CERCLA.	· Soil excavation activities increase potential exposure to remedial workers but HASP and engineering controls would minimize health risks. Soil excavation is expected to take approximately 1 to 2 weeks. Increased exposure to the community is minimal. Off-site treatment and disposal performed following federal and state regulations for community protection. · Groundwater-use restrictions are the same as Alternative II-2.	· Excavation is readily implementable but dewatering may be necessary if excavation extends below the water table. · Wetlands protection and restoration will likely be required. · Uses basic monitoring practices. · Deed and land-use restrictions are easily implemented considering that wetland area is slated for recreation/open space.	30-Year NPW: $667,000

(Continued)

TABLE 7-1
COMPARATIVE ANALYSIS OF ALTERNATIVES
AREA 2 WETLAND
AOC 57

FOCUSED FEASIBILITY STUDY
DEVENS, MASSACHUSETTS

	THRESHOLD CRITERIA		BALANCING CRITERIA				
ALTERNATIVE	**OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT**	**COMPLIANCE WITH ARARs**	**LONG-TERM EFFECTIVENESS AND PERMANENCE**	**REDUCTION OF TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT**	**SHORT-TERM EFFECTIVENESS**	**IMPLEMENTABILITY**	**COSTS**
No. II-4: Excavation (for Unrestricted Use) and Institutional Controls	· Protective of both possible future-use and unrestricted-use exposures to soil by excavating soil with COCs exceeding risk-based PRGs and treating/disposing offsite. · Protective of unrestricted-use exposures to wetland groundwater by enforcing zoning and deed restrictions.	· Same as Alternative II-3.	· Similar to Alternative II-3 except that soils containing COCs exceeding possible future-use and unrestricted-use PRGs are excavated to permanently minimize risk to the construction worker and residential receptor. · Zoning and deed restrictions are implemented only to restrict potable use of groundwater.	· Same as Alternative II-3, except that a greater quantity of soil is removed thereby providing a greater reduction in COC toxicity and volume. · Satisfies the statutory preference for treatment under CERCLA.	· Same as Alternative II-3 except that soil excavation is expected to take approximately 2 to 4 weeks therefore increasing the potential exposure to on-site workers.	· Similar to Alternative II-3 except that a larger area would be excavated potentially requiring greater dewatering and wetland restoration.	30-Year NPW: $1,321,000

Notes:

ARARs = Applicable or Relevant and Appropriate Requirements
COCs = contaminants of concern
HASP = Health and Safety Plan
NPW = Net Present Worth
PRGs = preliminary remediation goals

TABLE 7-2
COMPARATIVE ANALYSIS OF ALTERNATIVES
AREA 3 UPLAND & WETLAND
AOC 57

FOCUSED FEASIBILITY STUDY
DEVENS, MASSACHUSETTS

	THRESHOLD CRITERIA		BALANCING CRITERIA				
ALTERNATIVE	OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT	COMPLIANCE WITH ARARs	LONG-TERM EFFECTIVENESS AND PERMANENCE	REDUCTION OF TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT	SHORT-TERM EFFECTIVENESS	IMPLEMENTABILITY	COSTS
No. III-1: No Action	· Not protective of human health for possible future-use and unrestricted-use exposure scenarios to soil groundwater and unrestricted-use exposure scenario to soil.	· Chemical-specific ARAR concentrations are currently exceeded at only two monitoring wells. · No monitoring is performed to verify attainment of ARARs by natural attenuation processes or to assess for COC migration. · Location- and action-specific ARARs are not triggered.	· No controls implemented to reduce COC concentrations or minimize exposure to COCs in soil. · Risk reduction in groundwater likely will occur through natural attenuation processes but effectiveness and permanence are not assessed.	· Does not employ active removal or treatment processes to address soil or groundwater contamination.	· Potential risk from soil exposure at the site would exist indefinitely should residential development be permitted in the Area 3 wetland. · No action; therefore no risk to remedial workers or the environment.	· No action to implement. Inability to monitor COCs may present administrative and public acceptance obstacles.	$0
No. III-2: Limited Action	· Protective of human health by implementing zoning and deed restrictions that prohibit possible future-use and unrestricted-use exposure to upland and wetland groundwater, and unrestricted-use exposure to wetland soil.	· Chemical-specific ARAR concentrations currently exceeded in only two monitoring wells. Former soil removal action has reduced contamination source. Eventual reduction of COCs to meet chemical-specific ARARs in groundwater will be achieved through natural attenuation processes. · Monitoring performed to verify attainment of ARARs. · No location- and action-specific ARARs triggered.	· Zoning and deed restrictions are implemented to prohibit possible future-use and unrestricted use exposure to upland and wetland groundwater; and unrestricted use exposure to wetland soil. Long-term maintenance of these controls is essential for long-term effectiveness. · Acceptable risk eventually achieved in groundwater by natural attenuation processes that permanently reduce COCs to PRGs. · Reduction of COC concentrations to PRGs in groundwater confirmed by environmental monitoring. · No long-term controls of groundwater required once PRGs are achieved.	· Does not employ active removal or treatment processes to address soil contamination. · Eventual reduction of toxicity and volume of COCs will occur through natural attenuation processes in groundwater. Monitoring of COCs is performed to document reduction.	· Deed and land-use restrictions can be implemented within 2 to 6 months but would be enforced indefinitely to minimize soil exposure. · Groundwater-use restrictions protect receptors until natural attenuation processes reduce COCs below PRGs. · No increased exposure to community occurs from implementation because there are no active or intrusive remedial actions performed. HASP is protective of on-site workers (environmental sampling).	· Uses basic monitoring practices. · Deed and land-use restrictions are easily implemented considering that AOC 57upland and wetland areas are slated for rail, Industrial, trade related and recreation/open space.	30-Year NPW: $298,000
No. III-3: Excavation (for Unrestricted Use) and Institutional Controls	· Protective of unrestricted-use exposure to soil by excavating soil with COCs exceeding risk-based PRGs and treating/disposing offsite. · Protective of possible future-use and unrestricted-use exposures to upland and wetland groundwater, respectively, by enforcing zoning and deed restrictions.	· Same as Alternative III-2 except that location- and action specific ARARs pertaining to wetlands and endangered species protection, surface water runoff control, WWTP pretreatment requirements, and management of excavated wastes would also be complied with for the soil removal component.	· Similar to Alternative III-2 except that soils containing COCs exceeding unrestricted-use PRGs are excavated to permanently minimize risk to the residential receptor. · Zoning and deed restrictions are implemented only to prohibit possible future-use and unrestricted-use exposure to upland and wetland groundwater.	· Employs soil removal and off-site treatment /disposal to reduce toxicity and volume of COCs in soil. · Reduction of toxicity and volume of COCs in groundwater and groundwater monitoring will occur as discussed in Alternative III-2. · Satisfies the statutory preference for treatment under CERCLA.	· Soil excavation activities increase potential exposure to remedial workers but HASP and engineering controls would minimize health risks. Soil excavation is expected to take approximately 1 week. Increased exposure to the community is minimal. Off-site treatment and disposal performed following federal and state regulations for community protection. · Groundwater-use restrictions are same as Alternative III-2.	· Excavation is readily implementable but dewatering may be necessary if excavation extends below the water table. · Wetland protection and restoration will likely be required. · Uses basic monitoring practices. · Deed and land-use restrictions are easily implemented as in Alternative III-2.	30-Year NPW: $387,000

(Continued)

Notes:

ARARs	=	Applicable or Relevant and Appropriate Requirements
COCs	=	contaminants of concern
HASP	=	Health and Safety Plan
NPW	=	Net Present Worth
PRGs	=	preliminary remediation goals

APPENDIX A

RISK-BASED CONCENTRATION CALCULATIONS

Evaluation of Residual Risks at AOC 57

Purpose

This appendix provides an evaluation of residual health risks that would be associated with AOC 57 after chemicals of concern (COCs) in Site soil and groundwater have been reduced to concentrations that do not exceed the preliminary remediation goals (PRGs) identified in this Focused Feasibility Study (FFS). PRGs represent chemical concentrations that are protective of human health and the environment. The purpose of this residual risk evaluation is to demonstrate that cumulative receptor risks will meet USEPA risk management criteria if the COC concentrations at the site do not exceed the PRGs.

Background

As discussed in Sections 2 and 3 of the FFS, the results of the human health risk assessment performed for AOC 57 indicated that soil and groundwater at upland and/or wetland portions of Area 2 and Area 3 posed health risks in excess of USEPA risk management criteria. Cancer risks associated with potential exposures to soils were within the USEPA cancer risk range, but non-cancer risks exceeded USEPA risk management criteria in Area 2 and Area 3 wetland soils (Table 2-10). Cancer and non-cancer risks associated with future use of groundwater as potable water also exceeded USEPA risk management criteria (Table 2-10). Therefore, PRGs for soil were identified principally to be protective for non-cancer health risks; the PRGs that are protective for non-cancer risks are also protective for cancer risks. PRGs for groundwater were selected to be protective for potable use of the groundwater. Tables 3-1 and 3-2 of the FFS provide summaries of the land uses and exposure media for which health risks in excess of USEPA risk management criteria were calculated. For those media, PRGs have been proposed in this FFS. The selected PRGs for soil and groundwater are identified in Tables 3-3 and 3-4, respectively of this FFS.

Methods

Residual risks were only evaluated for soils because the PRGs for groundwater have been set equal to the Massachusetts and Federal Maximum Contaminant Levels (MCLs). MCLs are enforceable drinking water standards that are protective of human health. Groundwater containing chemicals that are equal to or less than MCLs is considered to be safe for potable use. Therefore, if cancer and non-cancer health risks associated with soils meet USEPA risk management criteria, and groundwater contaminants meet MCLs, then cumulative risks to an individual from Site media are considered to be within acceptable ranges as estimated by the USEPA.

Table 1 summarizes the information presented in Tables 3-1 through 3-4 of the FFS. As shown in Table 1, PRGs were developed for COCs in surface soil and subsurface soil in the wetland (recreational) portion of Area 2, and for COCs in surface soils in the wetland (recreational) portion of Area 3. PRGs were developed to be protective of construction worker exposures (Area 2 wetland subsurface soil only), and residential exposures (Area 2 and Area 3 soils).

Residual risks were evaluated by re-calculating Site risks using the PRGs as the EPCs for the COCs in soil. The risks associated with those exposures were then added to the risks associated with exposures to the remaining chemicals of potential concern (COPCs) evaluated in the risk assessment. The total risks were then compared to USEPA risk management criteria. The residual risk evaluation was performed as follows:

1. Residual risks were calculated using the same receptor exposure parameters, dose-response data, and EPCs as those used in the AOC 57 human health risk assessment. Residual risks were only calculated for non-cancer health effects because cancer risks for AOC 57 soils did not exceed USEPA risk management criteria (PRGs were identified based on non-cancer health risks). Residual risks for residential land use are based on risks to a child resident. The child resident receptor is a more sensitive scenario for evaluating non-cancer risks; non-cancer risks for an adult resident will be lower than non-cancer risks for a child resident. Risk calculation spreadsheets are provided in Attachment A.

2. For the chemicals and media for which PRGs were developed (i.e., the COCs), the EPCs used to calculate residual risk are the receptor- and medium-specific PRGs identified in Table 1 (i.e., the EPCs

used in the human health risk assessment were replaced with the receptor- and medium-specific PRGs).

3. Risks for the media requiring PRGs were added to the risks for other soil exposure media to calculate total receptor risk for exposure to Site soil.

4. Non-cancer risks were evaluated by target organ effect as described in the AOC 57 human health risk assessment. Target-organ specific hazard index values were compared to the USEPA threshold hazard index value of 1.

Results

Tables 2 through 4 provide summaries of the residual risks for AOC 57 soils. The results of the residual risk calculations show that target organ-based hazard index values do not exceed 1 for any of the receptor scenarios evaluated.

The following conclusions may be drawn from these results:

1. If concentrations of Aroclor-1260 and lead in Area 2 subsurface soils are equal to or lower than the construction-worker based PRGs for these COCs, Area 2 soils will not pose a hazard index greater than 1 to future construction workers.

2. If concentrations of Aroclor-1260 and arsenic in Area 2 surface soils, and concentrations of Aroclor-1260, chromium, lead, and C11-C22 aromatic EPH in Area 2 subsurface soils, are equal to or lower than the child-resident based PRGs for these COCs, Area 2 soils will not pose a hazard index greater than 1 for future unrestricted land use.

3. If concentrations of C11-C22 aromatic EPH in Area 3 surface soils are equal to or lower than the child-resident based PRG for this COC, Area 3 soils will not pose a hazard index greater than 1 for future unrestricted land use.

TABLE 1
SUMMARY OF RISK-BASED PRELIMINARY REMEDIATION GOALS FOR SOIL
AOC 57
FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MASSACHUSETTS

Area	Land Use	Medium	COC	PRG (mg/kg)
Area 2 - Industrial (Upland)	Current			None required
	Future - commercial			None required
	Future - unrestricted			None required
Area 2 - Recreational (Wetland)	Current			None required
	Future - Construction worker	Surface soil		None required
		Subsurface soil	**Aroclor-1260**	**3.5**
			Lead	**600**
	Future - unrestricted	**Surface soil**	**Arsenic**	**21**
			Aroclor-1260	**0.5**
		Subsurface soil	**Chromium**	**550**
			Aroclor-1260	**0.5**
			C11-C22	**930**
			Lead	**400**
Area 3 - Industrial (Upland)	Current			None required
	Future - commercial			None required
	Future - unrestricted			None required
Area 3 - Recreational (Wetland)	Current			None required
	Future - Construction worker			None required
	Future - unrestricted	**Surface soil**	**C11-C22**	**930**
		Subsurface soil		None required

Note:

The informatio used to compile this table is presented in Tables 3-1 through 3-4 of the Focused Feasibility Study Report.

These PRGs are based on receptor risks to soil. Achieving the PRGs listed in this table should enable the residual receptor risks to be at or below a target-organ specific hazard index of 1 for soil and a cummulative receptor cancer risk at or below 1E-04 for soil.

These PRGs do not consider additive risk from groundwater. However, groundwater PRGs have been set at State and Federal drinking water to ensure that groundwater would not pose an unacceptable health risk if it was used as a source of potable water.

TABLE 2
SUMMARY OF NON-CANCER RESIDUAL RISKS FOR SOIL
AREA 2 RECREATIONAL - CONSTRUCTION WORKER
AOC 57
FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MASSACHUSETTS

Medium	Exposure Point Concentration (mg/kg)	Chemical	Non-Carcinogenic Hazard Quotient				
			Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface Soil	47.9	Arsenic	Skin	7.5E-01	NA	7.1E-02	8.2E-01
	273	Manganese	NOAEL (nervous system)[1]	7.1E-02	4.0E-03	NA	7.5E-02
	3.6	Aroclor-1260	Immune system	3.4E-01	NA	1.8E-01	5.2E-01
	21	C9-C12 Aliphatics	Nervous system	1.6E-05	7.2E-10	9.2E-06	2.5E-05
	17	C9-C10 Aromatics	Kidney	2.7E-04	2.0E-08	1.5E-04	4.2E-04
	298	C9-C18 Aliphatics	Nervous system	2.3E-04	1.0E-08	1.3E-04	3.6E-04
	3640	C19-C36 Aliphatics	Liver	2.8E-04	NA	1.6E-04	4.4E-04
	1130	C11-C22 Aromatics	Kidney	1.8E-02	1.1E-06	1.0E-02	2.8E-02
		(Total)		1.2E+00	4.0E-03	2.6E-01	1E+00
Subsurface Soil	21	Arsenic	Skin	3.3E-01	NA	3.1E-02	3.6E-01
	2410	Chromium	NOAEL (GI)[2]	5.7E-01	1.6E-02	NA	5.9E-01
	169	Manganese	NOAEL (nervous system)[1]	1.1E-02	2.4E-03	NA	1.3E-02
	0.0113	Dieldrin	Liver	1.1E-03	NA	NA	1.1E-03
	0.482	Aroclor-1248	Immune system	4.5E-02	NA	2.4E-02	6.9E-02
	3.5	***Aroclor-1260***	Immune system	***3.3E-01***	***NA***	***1.7E-01***	***5.0E-01***
	130	C9-C12 Aliphatics	Nervous system	1.0E-04	4.5E-09	5.7E-05	1.6E-04
	93	C9-C10 Aromatics	Kidney	1.5E-03	1.1E-07	8.3E-04	2.3E-03
	1860	C9-C18 Aliphatics	Nervous system	1.5E-03	6.4E-08	8.2E-04	2.3E-03
	22700	C19-C36 Aliphatics	Liver	1.8E-03	NA	1.0E-03	2.8E-03
	7050	C11-C22 Aromatics	Kidney	1.1E-01	6.9E-06	6.3E-02	1.7E-01
		(Total)		1.4E+00	1.8E-02	2.9E-01	2E+00
				Total Hazard Index Across All Media and All Exposure Routes			3E+00
						Total [Skin] HI =	1E+00
						Total [Liver] HI =	4E-03
						Total [Immune system] HI =	***1E+00***
						Total [Nervous system] HI =	9E-02
						Total [Kidney] HI =	2E-01
						Total [GI] HI =	6E-01
						Total [NOAEL] HI =	7E-01

Notes:

This table presents the non-cancer health risks that are estimated for the Site after exposure point concentrations (EPCs) of chemicals of concern (COCs) have been reduced to levels equal to or less than the the preliminary remediation goals (PRGs).

The table is developed using the information presented in the risk calculation spreadsheets provided in Attachment A.

EPCs and hazard index values for COCs are bolded. For these chemicals, the PRG is used as the EPC.

1 - RfD is based on NOAEL dose level. However, higher doses in study used to develop RfD were associated with effects on the nervous system. Therefore, the HQ for this chemical was included in the segregated HI for effects to the nervous system to provide a conservative estimate of the HI.

2 - RfD is based on NOAEL dose level. However, higher doses in study used to develop RfD were associated with effects on the GI system. Therefore, the HQ for this chemical was included in the segregated HI for effects to the GI system to provide a conservative estimate of the HI.

NA - No toxicity data
NOAEL - No observable adverse effect level
HQ - Hazard quotient
HI - Hazard index

TABLE 3
SUMMARY OF NON-CANCER RESIDUAL RISKS FOR SOIL
AREA 2 RECREATIONAL - CHILD RESIDENT
AOC 57
FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MASSACHUSETTS

Medium	Exposure Point Concentration (mg/kg)	Chemical	Non-Carcinogenic Hazard Quotient				
			Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface Soil	**21**	***Arsenic***	Skin	***3.8E-01***	***NA***	***1.2E-01***	***5.0E-01***
	273	Manganese	NOAEL (nervous system)[1]	2.1E-02	1.0E-03	NA	2.2E-02
	0.5	***Aroclor-1260***	Immune system	***1.4E-01***	***NA***	***2.5E-01***	***3.9E-01***
	21	C9-C12 Aliphatics	Nervous system	1.9E-04	1.9E-09	3.6E-04	5.5E-04
	17	C9-C10 Aromatics	Kidney	3.1E-03	5.1E-08	6.0E-03	9.1E-03
	298	C9-C18 Aliphatics	Nervous system	2.7E-03	2.7E-08	5.2E-03	7.9E-03
	3640	C19-C36 Aliphatics	Liver	3.3E-03	NA	6.3E-03	9.6E-03
	1130	C11-C22 Aromatics	Kidney	2.1E-01	2.9E-06	4.0E-01	6.1E-01
		(Total)		7.6E-01	1.0E-03	7.9E-01	2E+00
Subsurface Soil	21	Arsenic	Skin	3.8E-01	NA	1.2E-01	5.0E-01
	550	***Chromium***	NOAEL (GI)[2]	***1.0E+00***	***9.8E-04***	***NA***	***1.0E+00***
	169	Manganese	NOAEL (nervous system)[1]	1.3E-02	6.2E-04	NA	1.4E-02
	0.0113	Dieldrin	Liver	1.2E-03	NA	NA	1.2E-03
	0.482	Aroclor-1248	Immune system	1.3E-01	NA	2.4E-01	3.7E-01
	0.5	***Aroclor-1260***	Immune system	***1.4E-01***	***NA***	***2.5E-01***	***3.9E-01***
	130	C9-C12 Aliphatics	Nervous system	1.2E-03	1.2E-08	2.3E-03	3.5E-03
	93	C9-C10 Aromatics	Kidney	1.7E-02	2.8E-07	3.3E-02	5.0E-02
	1860	C9-C18 Aliphatics	Nervous system	1.7E-02	1.7E-07	3.2E-02	4.9E-02
	22700	C19-C36 Aliphatics	Liver	2.1E-02	NA	3.9E-02	6.0E-02
	930	***C11-C22 Aromatics***	Kidney	***1.7E-01***	***2.4E-06***	***3.3E-01***	***5.0E-01***
		(Total)		1.9E+00	1.6E-03	1.0E+00	2.9E+00
					Total Hazard Index Across All Media and All Exposure Routes		4.5E+00
						Total [Skin] HI =	***1E+00***
						Total [Liver] HI =	7E-02
						Total [Immune system] HI =	***1E+00***
						Total [Nervous system] HI =	1E-01
						Total [Kidney] HI =	***1E+00***
						Total [GI] HI =	***1E+00***
						Total [NOAEL] HI =	1E+00

Notes:

This table presents the non-cancer health risks that are estimated for the Site after exposure point concentrations (EPCs) of chemicals of concern (COCs) have been reduced to levels equal to or less than the the preliminary remediation goals (PRGs).

The table is developed using the information presented in the risk calculation spreadsheets provided in Attachment A.

EPCs and hazard index values for COCs are bolded. For these chemicals, the PRG is used as the EPC.

1 - RfD is based on NOAEL dose level. However, higher doses in study used to develop RfD were associated with effects on the nervous system. Therefore, the HQ for this chemical was included in the segregated HI for effects to the nervous system to provide a conservative estimate of the HI.

2 - RfD is based on NOAEL dose level. However, higher doses in study used to develop RfD were associated with effects on the GI system. Therefore, the HQ for this chemical was included in the segregated HI for effects to the GI system to provide a conservative estimate of the HI.

NA - No toxicity data
NOAEL - No observable adverse effect level
HQ - Hazard quotient
HI - Hazard index

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TABLE 4
SUMMARY OF NON-CANCER RESIDUAL RISKS FOR SOIL
AREA 3 RECREATIONAL - CHILD RESIDENT
AOC 57
FOCUSED FEASIBILITY STUDY REPORT
DEVENS, MASSACHUSETTS

Medium	Exposure Point Concentration (mg/kg)	Chemical	Non-Carcinogenic Hazard Quotient				
			Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface Soil	28	Arsenic	Skin	5.1E-01	NA	1.6E-01	6.7E-01
	170	Manganese	NOAEL (nervous system)[1]	1.3E-02	6.3E-04	NA	1.4E-02
	0.14	Dieldrin	Liver	1.5E-02	NA	NA	1.5E-02
	1500	C9-C12 Aliphatics	Nervous system	1.4E-02	1.4E-07	2.6E-02	4.0E-02
	600	C9-C10 Aromatics	Kidney	1.1E-01	1.8E-06	2.1E-01	3.2E-01
	1300	C9-C18 Aliphatics	Nervous system	1.2E-02	1.2E-07	2.3E-02	3.5E-02
	20000	C19-C36 Aliphatics	Liver	1.8E-02	NA	3.5E-02	5.3E-02
	930	***C11-C22 Aromatics***	Kidney	***1.7E-01***	***2.4E-06***	***3.3E-01***	***5.0E-01***
		(Total)		8.6E-01	6.3E-04	7.8E-01	2E+00
Subsurface Soil	28.2	Arsenic	Skin	5.2E-01	NA	1.6E-01	6.8E-01
		(Total)		5.2E-01	0.0E+00	1.6E-01	7E-01
						Total Hazard Index Across All Media and All Exposure Routes	2E+00
						Total [Skin] HI =	1E+00
						Total [Liver] HI =	7E-02
						Total [Nervous system] HI =	9E-02
						Total [Kidney] HI =	***8E-01***
						Total [NOAEL] HI =	1E-02

Notes:

This table presents the non-cancer health risks that are estimated for the Site after exposure point concentrations (EPCs) of chemicals of concern (COCs) have been reduced to levels equal to or less than the the preliminary remediation goals (PRGs).

The table is developed using the information presented in the risk calculation spreadsheets provided in Attachment A.

EPCs and hazard index values for COCs are bolded. For these chemicals, the PRG is used as the EPC.

1 - RfD is based on NOAEL dose level. However, higher doses in study used to develop RfD were associated with effects on the nervous system. Therefore, the HQ for this chemical was included in the segregated HI for effects to the nervous system to provide a conservative estimate of the HI.

NA - No toxicity data
NOAEL - No observable adverse effect level
HQ - Hazard quotient
HI - Hazard index

CON-SB2R-RESR
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SUBSURFACE SOIL - RME
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA

09-Jun-00

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SOIL	CS	See Below*	mg/kg
INGESTION RATE	IR	480	mg/day
FRACTION INGESTED	FI	100%	
SOIL ADHERENCE FACTOR	SAF	0.28	mg/cm^2
SURFACE AREA	SA	5200	cm^2
CONVERSION FACTOR	CF	0.000001	kg/mg
BODY WEIGHT	BW	70	kg
EXPOSURE FREQUENCY	EF	250	days/year
EXPOSURE DURATION	ED	0.5	years
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	0.5	years
DERMAL ABSORPTION EFFICIENCY	AE	Chemical-specific	unitless

Notes:
For noncarcinogenic effects: AT = ED
The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.
*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{\text{CS x IR x FI x CF x EF x ED}}{\text{BW x AT x 365 days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{\text{CS x SA x SAF x AE x CF x EF x ED}}{\text{BW x AT x 365 days/yr}}$$

CON-SB2R-RESR

INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SUBSURFACE SOIL - RME

FUTURE CONSTRUCTION WORKER

AOC 57 AREA 2 RECREATIONAL

FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	CANCER SLOPE FACTOR ORAL (mg/kg-day)-1	CANCER SLOPE FACTOR DERMAL (mg/kg-day)-1	CANCER RISK INGESTION	CANCER RISK DERMAL	TOTAL CANCER RISK	PERCENT TOTAL RISK
Arsenic	21	7.0E-07	0.03	6.4E-08	1.5E+00	1.60E+00	1.1E-06	1.0E-07	1.2E-06	73.64%
Lead	5060	1.7E-04	ND	0.0E+00	ND	ND				
Dieldrin	0.0113	3.8E-10	ND	0.0E+00	1.6E+01	ND	6.1E-09		6.1E-09	0.39%
Aroclor- 1248	0.482	1.6E-08	0.14	6.9E-09	2.0E+00	2.50E+00	3.2E-08	1.7E-08	5.0E-08	3.14%
Aroclor-1260	3.5	1.2E-07	0.14	5.0E-08	2.0E+00	2.50E+00	2.3E-07	1.2E-07	3.6E-07	22.83%
SUMMARY CANCER RISK							1E-06	2E-07	2E-06	

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	REFERENCE DOSE ORAL (mg/kg-day)	REFERENCE DOSE DERMAL (mg/kg-day)	HAZARD QUOTIENT INGESTION	HAZARD QUOTIENT DERMAL	TOTAL HAZARD QUOTIENT	PERCENT TOTAL RISK
Aluminum	6970	3.3E-02	ND	0.0E+00	1.0E+00	ND	3.3E-02		3.3E-02	
Arsenic	21	9.9E-05	0.03	9.0E-06	3.0E-04	2.9E-04	3.3E-01	3.1E-02	3.6E-01	20.86%
Chromium	2410	1.1E-02	ND	0.0E+00	2.0E-02	5.0E-04	5.7E-01	0.0E+00	5.7E-01	32.82%
Iron	6880	3.2E-02	ND	0.0E+00	ND	ND				
Lead	5060	2.4E-02	ND	0.0E+00	ND	ND				
Manganese	169	7.9E-04	ND	0.0E+00	7.1E-02	4.3E-03	1.1E-02	0.0E+00	1.1E-02	0.65%
Dieldrin	0.0113	5.3E-08	ND	0.0E+00	5.0E-05	ND	1.1E-03		1.1E-03	0.06%
Aroclor-1248	0.482	2.3E-06	0.14	9.6E-07	5.0E-05	4.0E-05	4.5E-02	2.4E-02	6.9E-02	4.02%
Aroclor-1260	3.5	1.6E-05	0.14	7.0E-06	5.0E-05	4.0E-05	3.3E-01	1.7E-01	5.0E-01	29.19%
VPH										
C9-C12 Aliphatics	130	6.1E-04	0.17	3.1E-04	6.0E+00	5.5E+00	1.0E-04	5.7E-05	1.6E-04	0.009%
C9-C10 Aromatics	93	4.4E-04	0.17	2.3E-04	3.0E-01	2.7E-01	1.5E-03	8.3E-04	2.3E-03	0.13%
EPH										
C9-C18 Aliphatics	1860	8.7E-03	0.17	4.5E-03	6.0E+00	5.5E+00	1.5E-03	8.2E-04	2.3E-03	0.13%
C19-C36 Aliphatics	22,700	1.1E-01	0.17	5.5E-02	6.0E+01	5.5E+01	1.8E-03	1.0E-03	2.8E-03	0.16%
C11-C22 Aromatics	7050	3.3E-02	0.17	1.7E-02	3.0E-01	2.7E-01	1.1E-01	6.3E-02	1.7E-01	10.07%
SUMMARY HAZARD INDEX							1	0.3	2	

CON-SB2R
INHALATION EXPOSURE TO PARTICULATES IN SUBSURFACE SOIL - RME
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA

09-Jun-00

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SOIL*	CS	See below	mg/kg
CONCENTRATION AIR PARTICULATES	CAp	Calculated	mg/m^3
CONCENTRATION AIR VOLATILES	CAv	Calculated	mg/m^3
VOLATILIZATION FACTOR**	VF	Calculated	m^3/kg
PARTICULATE EMISSIONS FACTOR	PEF	1.32E+09	ug/m^3
INHALATION RATE	IhR	3.3	$m^3/hour$
BODY WEIGHT	BW	70	kg
EXPOSURE TIME	ET	8	hours/day
EXPOSURE FREQUENCY	EF	250	days/year
EXPOSURE DURATION	ED	0.5	years
RELATIVE ABSORPTION FACTOR	RAF	100%	
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	0.50	years

Notes: * Soil concentration used is the lesser of the 95 % upper confidence limit (UCL) & maximum concentration
**Volatilization factor used only for volatile chemicals of potential concern.
For noncarcinogenic effects: AT = ED
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE CONCENTRATION (mg/kg-day)

$$\text{INTAKE - INHALATION} = \frac{(CAp + Cav) \times RAF \times IhR \times ET \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

AIR CONCENTRATION PARTICULATES = CS x 1/PEF

AIR CONCENTRATION VOLATILES = CS x 1/VF
(VF not calculated because there are no VOCs selected as CPCs).

CON-SB2R
INHALATION EXPOSURE TO PARTICULATES IN SUBSURFACE SOIL - RME
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	VF (m^3/kg)	AIR CONCENTRATION VOLATILES (mg/m^3)	AIR CONCENTRATION PARTICULATES (mg/m^3)	INTAKE (mg/kg-day)	CANCER SLOPE FACTOR (mg/kg-day)-1	CANCER RISK	PERCENT TOTAL RISK
Arsenic	21	NA		1.6E-08	2.9E-11	1.5E+01	4.4E-10	0.32%
Chromium	2410	NA		1.8E-06	3.4E-09	4.1E+01	1.4E-07	99.67%
Lead	5060	NA		3.8E-06	7.1E-09	ND		
Dieldrin	0.0113	NA		8.6E-12	1.6E-14	1.6E+01	2.5E-13	0.00018%
Aroclor- 1248	0.482	NA		3.7E-10	6.7E-13	2.0E+00	1.3E-12	0.00097%
Aroclor-1260	3.5	NA		2.7E-09	4.9E-12	2.0E+00	9.8E-12	0.007%
						SUMMARY CANCER RISK	1E-07	

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	VF (m^3/kg)	AIR CONCENTRATION VOLATILES (mg/m^3)	AIR CONCENTRATION PARTICULATES (mg/m^3)	INTAKE (mg/kg-day)	REFERENCE DOSE (mg/kg-day)	HAZARD QUOTIENT	PERCENT TOTAL RISK
Aluminum	6970	NA		5.3E-06	1.4E-06	1.0E-03	1.4E-03	6.82%
Arsenic	21	NA		1.6E-08	4.1E-09	ND		
Chromium	2410	NA		1.8E-06	4.7E-07	2.9E-05	1.6E-02	81.33%
Iron	6880	NA		5.2E-06	1.3E-06	ND		
Lead	5060	NA		3.8E-06	9.9E-07	ND		
Manganese	169	NA		1.3E-07	3.3E-08	1.4E-05	2.4E-03	11.81%
Dieldrin	0.0113	NA		8.6E-12	2.2E-12	ND		
Aroclor-1248	0.482	NA		3.7E-10	9.4E-11	ND		
Aroclor-1260	3.5	NA		2.7E-09	6.8E-10	ND		
VPH		NA						
C9-C12 Aliphatics	130	NA		9.8E-08	2.5E-08	5.7E+00	4.5E-09	0.000022%
C9-C10 Aromatics	93	NA		7.0E-08	1.8E-08	1.7E-01	1.1E-07	0.00054%
EPH		NA						
C9-C18 Aliphatics	1860	NA		1.4E-06	3.6E-07	5.7E+00	6.4E-08	0.00032%
C19-C36 Aliphatics	22,700	NA		1.7E-05	4.4E-06	ND		
C11-C22 Aromatics	7050	NA		5.3E-06	1.4E-06	2.0E-01	6.9E-06	0.034%
						SUMMARY HAZARD INDEX	0.02	

RES-SB2RRESR
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SUBSURFACE SOIL - RME
UNRESTRICTED LAND USE - CHILD RESIDENT (1 TO 6 YEARS)
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA

09-Jun-00

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SOIL	CS	See Below*	mg/kg
INGESTION RATE	IR	200	mg/day
FRACTION INGESTED	FI	100%	
SOIL ADHERENCE FACTOR	SAF	1	mg/cm^2
SURFACE AREA EXPOSED	SA	2,045	cm^2
CONVERSION FACTOR	CF	0.000001	kg/mg
BODY WEIGHT	BW	15	kg
EXPOSURE FREQUENCY	EF	150	days/year
EXPOSURE DURATION	ED	6	years
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	6	years
DERMAL ABSORPTION EFFICIENCY	AE	Chemical-specific	unitless

Notes:
For noncarcinogenic effects: AT = ED
The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I:
Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.
*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.
ND = Value not determined NE = Route not evaluated

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times AE \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

RES-SB2RRESR
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SUBSURFACE SOIL - RME
UNRESTRICTED LAND USE - CHILD RESIDENT (1 TO 6 YEARS)
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	CANCER SLOPE FACTOR		CANCER RISK INGESTION	CANCER RISK DERMAL	TOTAL CANCER RISK	PERCENT TOTAL RISK
					ORAL (mg/kg-day)-1	DERMAL (mg/kg-day)-1				
Arsenic	21	9.9E-06	0.03	3.0E-06	1.5E+00	1.60E+00	1.5E-05	4.8E-06	2.0E-05	88.08%
Lead	400	1.9E-04	ND		ND	ND				
Dieldrin	0.0113	5.3E-09	ND		1.6E+01	ND	8.5E-08		8.5E-08	0.38%
Aroclor-1248	0.482	2.3E-07	0.14	3.2E-07	2.0E+00	2.50E+00	4.5E-07	8.1E-07	1.3E-06	5.67%
Aroclor-1260	0.5	2.3E-07	0.14	3.4E-07	2.0E+00	2.50E+00	4.7E-07	8.4E-07	1.3E-06	5.88%
						SUMMARY CANCER RISK	2E-05	6E-06	2E-05	

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	REFERENCE DOSE		HAZARD QUOTIENT INGESTION	HAZARD QUOTIENT DERMAL	TOTAL HAZARD QUOTIENT	PERCENT TOTAL RISK
					ORAL (mg/kg-day)	DERMAL (mg/kg-day)				
Aluminum	6970	3.8E-02	ND		ND	ND				
Arsenic	21	1.2E-04	0.03	3.5E-05	3.0E-04	2.9E-04	3.8E-01	1.2E-01	5.1E-01	17.22%
Chromium	550	3.0E-03	ND		3.0E-03	7.5E-05	1.0E+00	0.0E+00	1.0E+00	34.23%
Iron	6880	3.8E-02	ND		ND	ND				
Lead	400	2.2E-03	ND		ND	ND				
Manganese	169	9.3E-04	ND		7.1E-02	4.3E-03	1.3E-02	0.0E+00	1.3E-02	0.44%
Dieldrin	0.0113	6.2E-08	ND		5.0E-05	ND	1.2E-03		1.2E-03	0.04%
Aroclor-1248	0.482	2.6E-06	0.14	3.8E-06	2.0E-05	1.6E-05	1.3E-01	2.4E-01	3.7E-01	12.55%
Aroclor-1260	0.5	2.7E-06	0.14	3.9E-06	2.0E-05	1.6E-05	1.4E-01	2.5E-01	3.8E-01	13.02%
VPH										
C9-C12 Aliphatics	130	7.1E-04	0.17	1.2E-03	6.0E-01	5.5E-01	1.2E-03	2.3E-03	3.4E-03	0.12%
C9-C10 Aromatics	93	5.1E-04	0.17	8.9E-04	3.0E-02	2.7E-02	1.7E-02	3.3E-02	5.0E-02	1.70%
EPH										
C9-C18 Aliphatics	1860	1.0E-02	0.17	1.8E-02	6.0E-01	5.5E-01	1.7E-02	3.2E-02	4.9E-02	1.68%
C19-C36 Aliphatics	22700	1.2E-01	0.17	2.2E-01	6.0E+00	5.5E+00	2.1E-02	3.9E-02	6.0E-02	2.05%
C11-C22 Aromatics	930	5.1E-03	0.17	8.9E-03	3.0E-02	2.7E-02	1.7E-01	3.3E-01	5.0E-01	16.97%
					SUMMARY HAZARD INDEX		2	1	3	

RES-SB2RRESR
INHALATION EXPOSURE TO PARTICULATES IN SUBSURFACE SOIL - RME
UNRESTRICTED LAND USE - CHILD RESIDENT (1 TO 6 YEARS)
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SOIL*	CS	See below	mg/kg
CONCENTRATION AIR PARTICULATES	CAp	Calculated	mg/m³
CONCENTRATION AIR VOLATILES	CAv	Calculated	mg/m³
VOLATILIZATION FACTOR**	VF	Calculated	m³/kg
PARTICULATE EMISSIONS FACTOR	PEF	1.32E+09	ug/m³
INHALATION RATE	IhR	0.31	m³/hour
BODY WEIGHT	BW	15	kg
EXPOSURE TIME	ET	8	hours/day
EXPOSURE FREQUENCY	EF	150	days/year
EXPOSURE DURATION	ED	6	years
RELATIVE ABSORPTION FACTOR	RAF	100%	
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	6	years

Notes: * Soil concentration used is the lesser of the 95 % upper confidence limit (UCL) & maximum concentration
**Volatilization factor used only for volatile chemicals of potential concern.
For noncarcinogenic effects: AT = ED
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE CONCENTRATION (mg/kg-day)

$$\text{INTAKE - INHALATION} = \frac{(CAp + Cav) \times RAF \times IhR \times ET \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

AIR CONCENTRATION PARTICULATES = CS x 1/PEF

AIR CONCENTRATION VOLATILES = CS x 1/VF
(VF not calculated because there are no VOCs selected as CPCs).

RES-SB2RRESR
INHALATION EXPOSURE TO PARTICULATES IN SUBSURFACE SOIL - RME
UNRESTRICTED LAND USE - CHILD RESIDENT (1 TO 6 YEARS)
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	VF (m^3/kg)	AIR CONCENTRATION VOLATILES (mg/m^3)	AIR CONCENTRATION PARTICULATES (mg/m^3)	INTAKE (mg/kg-day)	CANCER SLOPE FACTOR (mg/kg-day)-1	CANCER RISK	PERCENT TOTAL RISK
Arsenic	21	NA		1.6E-08	9.3E-11	1.5E+01	1.4E-09	1.38%
Chromium	550	NA		4.2E-07	2.4E-09	4.1E+01	9.9E-08	98.61%
Lead	400	NA		3.0E-07	1.8E-09	ND		
Dieldrin	0.0113	NA		8.6E-12	5.0E-14	1.6E+01	8.0E-13	0.0008%
Aroclor-1248	0.482	NA		3.7E-10	2.1E-12	2.0E+00	4.3E-12	0.004%
Aroclor-1260	0.5	NA		3.8E-10	2.2E-12	2.0E+00	4.4E-12	0.004%
						SUMMARY CANCER RISK	1E-07	

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	VF (m^3/kg)	AIR CONCENTRATION VOLATILES (mg/m^3)	AIR CONCENTRATION PARTICULATES (mg/m^3)	INTAKE (mg/kg-day)	REFERENCE DOSE (mg/kg-day)	HAZARD QUOTIENT	PERCENT TOTAL RISK
Aluminum	6970	NA		5.3E-06	3.6E-07	1.0E-03	3.6E-04	18.31%
Arsenic	21	NA		1.6E-08	1.1E-09	ND		
Chromium	550	NA		4.2E-07	2.8E-08	2.9E-05	9.8E-04	49.83%
Iron	6880	NA		5.2E-06	3.5E-07	ND		
Lead	400	NA		3.0E-07	2.1E-08	ND		
Manganese	169	NA		1.3E-07	8.7E-09	1.4E-05	6.2E-04	31.71%
Dieldrin	0.0113	NA		8.6E-12	5.8E-13	ND		
Aroclor-1248	0.482	NA		3.7E-10	2.5E-11	ND		
Aroclor-1260	0.5	NA		3.8E-10	2.6E-11	ND		
VPH		NA						
C9-C12 Aliphatics	130	NA		9.8E-08	6.7E-09	5.7E-01	1.2E-08	
C9-C10 Aromatics	93	NA		7.0E-08	4.8E-09	1.7E-02	2.8E-07	0.014%
EPH		NA						
C9-C18 Aliphatics	1860	NA		1.4E-06	9.6E-08	5.7E-01	1.7E-07	0.009%
C19-C36 Aliphatics	22,700	NA		1.7E-05	1.2E-06	ND		
C11-C22 Aromatics	930	NA		7.0E-07	4.8E-08	2.0E-02	2.4E-06	0.12%
						SUMMARY HAZARD INDEX	0.002	

RES-SS3RRESR

INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - RME

UNRESTRICTED LAND USE - CHILD RESIDENT (1 TO 6 YEARS)

AOC 57 AREA 3 RECREATIONAL

FORT DEVENS, MA

09-Jun-00

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SOIL	CS	See Below*	mg/kg
INGESTION RATE	IR	200	mg/day
FRACTION INGESTED	FI	100%	
SOIL ADHERENCE FACTOR	SAF	1	mg/cm²
SURFACE AREA EXPOSED	SA	2,045	cm²
CONVERSION FACTOR	CF	0.000001	kg/mg
BODY WEIGHT	BW	15	kg
EXPOSURE FREQUENCY	EF	150	days/year
EXPOSURE DURATION	ED	6	years
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	6	years
DERMAL ABSORPTION EFFICIENCY	AE	Chemical-specific	unitless

Notes:

For noncarcinogenic effects: AT = ED

The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.

*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.

ND = Value not determined NE = Route not evaluated

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times AE \times CF \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

RES-SS3RRESR
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - RME
UNRESTRICTED LAND USE - CHILD RESIDENT (1 TO 6 YEARS)
AOC 57 AREA 3 RECREATIONAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	CANCER SLOPE FACTOR		CANCER RISK INGESTION	CANCER RISK DERMAL	TOTAL CANCER RISK	PERCENT TOTAL RISK
					ORAL (mg/kg-day)-1	DERMAL (mg/kg-day)-1				
Arsenic	28	1.3E-05	0.03	4.0E-06	1.5E+00	1.60E+00	2.0E-05	6.5E-06	2.6E-05	96.14%
Dieldrin	0.14	6.6E-08	ND	0.0E+00	1.6E+01	ND	1.1E-06		1.1E-06	3.86%
					SUMMARY CANCER RISK		2E-05	6E-06	3E-05	

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	REFERENCE DOSE		HAZARD QUOTIENT INGESTION	HAZARD QUOTIENT DERMAL	TOTAL HAZARD QUOTIENT	PERCENT TOTAL RISK
					ORAL (mg/kg-day)	DERMAL (mg/kg-day)				
Arsenic	28	1.5E-04	0.03	4.7E-05	3.0E-04	2.9E-04	5.1E-01	1.6E-01	6.7E-01	40.87%
Manganese	170	9.3E-04	ND		7.1E-02	ND	1.3E-02		1.3E-02	0.80%
Dieldrin	0.14	7.7E-07	ND		5.0E-05	ND	1.5E-02		1.5E-02	0.93%
VPH										
C9-C12 Aliphatics	1500	8.2E-03	0.17	1.4E-02	6.0E-01	5.5E-01	1.4E-02	2.6E-02	4.0E-02	2.41%
C9-C10 Aromatics	600	3.3E-03	0.17	5.7E-03	3.0E-02	2.7E-02	1.1E-01	2.1E-01	3.2E-01	19.49%
EPH										
C9-C18 Aliphatics	1300	7.1E-03	0.17	1.2E-02	6.0E-01	5.5E-01	1.2E-02	2.3E-02	3.4E-02	2.09%
C19-C36 Aliphatics	20,000	1.1E-01	0.17	1.9E-01	6.0E+00	5.5E+00	1.8E-02	3.5E-02	5.3E-02	3.21%
C11-C22 Aromatics	930	5.1E-03	0.17	8.9E-03	3.0E-02	2.7E-02	1.7E-01	3.3E-01	5.0E-01	30.21%
					SUMMARY HAZARD INDEX		1	1	2	

RES-SS3RRESR
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - RME
UNRESTRICTED LAND USE - CHILD RESIDENT (1 TO 6 YEARS)
AOC 57 AREA 3 RECREATIONAL
FORT DEVENS, MA

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SOIL*	CS	See below	mg/kg
CONCENTRATION AIR PARTICULATES	CAp	Calculated	mg/m^3
CONCENTRATION AIR VOLATILES	CAv	Calculated	mg/m^3
VOLATILIZATION FACTOR**	VF	Calculated	m^3/kg
PARTICULATE EMISSIONS FACTOR	PEF	1.32E+09	ug/m^3
INHALATION RATE	IhR	0.31	$m^3/hour$
BODY WEIGHT	BW	15	kg
EXPOSURE TIME	ET	8	hours/day
EXPOSURE FREQUENCY	EF	150	days/year
EXPOSURE DURATION	ED	6	years
RELATIVE ABSORPTION FACTOR	RAF	100%	
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	6	years

Notes: * Soil concentration used is the lesser of the 95 % upper confidence limit (UCL) & maximum concentration
**Volatilization factor used only for volatile chemicals of potential concern.
For noncarcinogenic effects: AT = ED
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE CONCENTRATION (mg/kg-day)

$$\text{INTAKE - INHALATION} = \frac{(CAp + Cav) \times RAF \times IhR \times ET \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

AIR CONCENTRATION PARTICULATES = CS x 1/PEF

AIR CONCENTRATION VOLATILES = CS x 1/VF
(VF not calculated because there are no VOCs selected as CPCs).

RES-SS3RRESR
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - RME
UNRESTRICTED LAND USE - CHILD RESIDENT (1 TO 6 YEARS)
AOC 57 AREA 3 RECREATIONAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	VF (m^3/kg)	AIR CONCENTRATION VOLATILES (mg/m³)	AIR CONCENTRATION PARTICULATES (mg/m³)	INTAKE (mg/kg-day)	CANCER SLOPE FACTOR (mg/kg-day)-1	CANCER RISK	PERCENT TOTAL RISK
Arsenic	28	NA		2.1E-08	1.2E-10	1.5E+01	1.9E-09	99.47%
Dieldrin	0.14	NA		1.1E-10	6.2E-13	1.6E+01	9.9E-12	0.53%
						SUMMARY CANCER RISK	2E-09	

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	VF (m^3/kg)	AIR CONCENTRATION VOLATILES (mg/m³)	AIR CONCENTRATION PARTICULATES (mg/m³)	INTAKE (mg/kg-day)	REFERENCE DOSE (mg/kg-day)	HAZARD QUOTIENT	PERCENT TOTAL RISK
Arsenic	28	NA		2.1E-08	1.4E-09	ND		
Manganese	170	NA		1.3E-07	8.8E-09	1.4E-05	6.3E-04	99.29%
Dieldrin	0.14	NA		1.1E-10	7.2E-12	ND		
VPH								
C9-C12 Aliphatics	1500	NA		1.1E-06	7.7E-08	5.7E-01	1.4E-07	0.022%
C9-C10 Aromatics	600	NA		4.5E-07	3.1E-08	1.7E-02	1.8E-06	0.29%
EPH								
C9-C18 Aliphatics	1300	NA		9.8E-07	6.7E-08	5.7E-01	1.2E-07	0.019%
C19-C36 Aliphatics	20,000	NA		1.5E-05	1.0E-06	ND		
C11-C22 Aromatics	930	NA		7.0E-07	4.8E-08	2.0E-02	2.4E-06	0.38%
						SUMMARY HAZARD INDEX	0.0006	

APPENDIX B

DETAILED COST SPREADSHEETS

AREA 2 - LIMITED ACTION ALTERNATIVE (II-2)

Capital Costs

	Unit	Unit Cost	Quantity	Total Cost
Direct Costs				
Boundary Survey for Institutional Controls - Area 2	EA	$1,500.00	1	$1,500
Institutional Controls (land use restrictions)	LS			$13,000
	Direct Construction Cost Sub			$14,500
Indirect Costs				
Survey Oversight	Day	$750.00	1	$750
Administrative Fees	LS			$1,000
	Total Indirect Costs Subtotal			$1,750
Total Capital Cost Subtotal				$16,250

Operation & Maintenance Costs

	Unit	Unit Cost	Quantity	Total Cost
Groundwater (6) & Surface (4) Sampling (one round)				
Arsenic (6010), Level 3, 30 day TAT - filtered and unfiltered	EA	$12.26	20	$245
PCE (VOC-8260), Level 3, 30 day TAT	EA	$133.60	10	$1,336
Scientist	Hours	$75.00	30	$2,250
Technician	Hours	$55.00	24	$1,320
ODCs (low flow sampling equip, expendables, mileage)	LS			$800
Summary Data Report:				
Engineer	Hours	$75.00	16	$1,200
Senior Scientist	Hours	$90.00	8	$720
Data Manager	Hours	$75.00	4	$300
ODCs (copies, phone, etc.)	LS			$100
	Subtotal GW&SW Sampling			$8,271
Annual Groundwater & Surface Water Sampling - 2X/year				$16,542
Present Worth of 3-Year GW & SW Sampling Program 2X/year @7%, n=3 yrs				$43,412
Present Worth of 30-year GW&SW sampling - 1X/yr @7%, yr 4..yr30				$80,931
Total Present Worth of 30-year GW & SW sampling program for Area 2				$124,343
Institutional Control Inspections (1 event/year)	Hours	$90.00	12	$1,080
Present Worth of 30-year IC Inspections - 1X/yr @7%, n=30yrs				$13,402
Five-Year Site/Institutional Control Reviews (every 5 years for 30 years)				
Meetings:				
Senior Scientist	Hours	$90.00	8	$720
Engineer	Hours	$75.00	8	$600
Evaluate Data/Current Situation:				
Senior Scientist	Hours	$90.00	20	$1,800
Engineer	Hours	$75.00	40	$3,000
ODCs (includes photocopying, phone, etc.)	LS			$500
Five-year Report:				
Senior Scientist	Hours	$90.00	40	$3,600
Engineer	Hours	$75.00	60	$4,500
Associate Scientist/Data Management	Hours	$75.00	40	$3,000
Clerical (formatting, photocopying, production, distribution)	Hours	$45.00	8	$360
ODCs (includes photocopying, phone, etc.)	LS			$1,000
	Subtotal 5-year site review			$19,080

Present Worth 5-Year Review (@7%, n=5,10..30 years)	$41,169
Total O&M Costs Subtotal	$178,914
Total Capital and O&M Cost	$195,164
Contingency (@25%)	$48,791
TOTAL COST OF LIMITED ACTION ALTERNATIVE - AREA 2	**$243,955**

Cost Sensitivity Analysis - Minimum Estimate
Assume capital costs remain the same.
Assume groundwater will attain MCLs after one year. Add two extra years validation for a total of 3 years monitoring.
Assume IC/site reviews will remain at 30 years.

Present Worth of 3-Year GW & SW Sampling Program 2X/year @7%, n=3 yrs	$43,412
Total O&M Costs Subtotal	$97,983
Total Capital and O&M Cost	$114,233
Contingency (@25%)	$28,558
MINIMUM COST OF LIMITED ACTION ALTERNATIVE - AREA 2	$142,791

NON-DISCOUNTED COSTS FOR LIMITED ACTON ALTERNATIVE - AREA 2
(assuming no inflation)

Total Capital Cost	$16,250
Total O&M Cost:	
- Annual Groundwater & Surface Water Sampling - 2X/year for years 1,2,&3	$49,627
- Annual Groundwater & Surface Water Sampling - 1X/year for years 4..30	$223,322
- Institutional Control Inspections (1 event/year for 30 years)	$32,400
- Five-Year Site/Institutional Control Reviews (every 5 years for 30 years)	$114,480
Total O&M Costs Subtotal	$419,830
Total Capitcal and O&M Cost	$436,080
Contingency (@25%)	$109,020
TOTAL NON-DISCOUNTED COST OF LIMITED ACTION ALTERNATIVE - AREA 2	$545,100

AREA 2 - EXCAVATION FOR POSSIBLE FUTURE USE (II-3)

Capital Costs

Direct Costs	Unit	Unit Cost	Quantity	Total Cost
Wetland Delineation/reporting	Day	$750.00	2	$1,500
Pre-Design Investigation (assume same COCs as confirmatory samples below:)				
- 2 days direct push drilling/soil sampling	Day	$1,200.00	2	$2,400
- Lead (6010), Level 3 (16 locations at 2 depths)	EA	$17.71	32	$567
- PCB (8082), Level 3 (16 locations at 2 depths)	EA	$84.47	32	$2,703
	Pre-Design Investigation Subtotal:			$5,670
Soil excavation (640 CY, 1152 tons)and offsite treatment/disposal:				
Mob/Demob (includes onsite storage)	LS			$8,000
Construct Decon Pad/Temporary Stockpile Areas/Erosion Control	LS			$5,000
Safety Barriers/Stockpile Maintenance	LS			$1,000
Clear trees from area to be excavated (medium trees); chip	Acre	$4,000.00	0.25	$1,000
Stump Removal (assume 15 medium size trees); remove soil	EA	$176.30	15	$2,645
Soil Excavation/Load Out Handling	Ton	$20.00	1152	$23,040
Dewatering	Gallon	$0.10	5000	$500
Transport & Dispose RCRA Soil (assume 1/4 total soil)	Ton	$295.00	288	$84,960
Transport & Dispose MA99 Soil (assume 3/4 total soil)	Ton	$70.00	864	$60,480
Transport & Dispose Water	Gallon	$0.57	5000	$2,850
Backfill/Restoration (clean fill- assume 320 CY X 1.25 bulk)	CY	$18.00	400	$7,200
Backfill/Restoration (wetland material - peat/compost-seed X 1.25)	CY	$30.00	400	$12,000
Replant trees (estimate 1 per 15' offset)	EA	$80.00	35	$2,800
	Excavation Subtotal:			$211,475
Confirmatory Samples- 4,320 SF area(assume 1/900SF&every 30 feet along wall, plus 1/3 are resampled):				
Lead (6010), Level 3, 3 day TAT	EA	$17.71	27	$478
PCB (8082), Level 3, 3 day TAT	EA	$84.47	27	$2,281
Analytical screening - XRF for lead, immunoassay for PCB's	LS			$2,500
ODCs (sampling equip, H&S, expendables, mileage, sample courier	LS			$1,200
Summary Data Report:				
Engineer	Hours	$75.00	40	$3,000
Senior Scientist	Hours	$90.00	20	$1,800
Drafting	Hours	$55.00	12	$660
Associate Scientist/Data Management	Hours	$75.00	4	$300
Clerical (formatting, photocopying, production, distribution)	Hours	$45.00	8	$360
ODCs (copies, phone, etc.)	LS			$300
	Subtotal Confirmatory Samples:			$12,879
Waste Characterization Samples of Soil:				
Full Characterization to determine if hazardous (1/200tons)	EA	$2,410.00	8	$19,280
Institutional Controls (land use restrictions)	LS			$13,000
Boundary Survey for Construction/Institutional Controls - Area 2	EA	$1,500.00	1	$1,500
	Direct Cost Subtotal			$265,303
Indirect Costs				
Design/Permitting @ 10% of direct cost	LS			$26,530
Wetland Restoration Plan	Day	$750.00	2	$1,500
Health and Safety @ 5% of direct cost	LS			$13,265

Pre-constr. mtg. - stake locations/survey oversight	Day	$750.00	3	$2,250
Constructon Support Services @ 10% of direct cost	LS			$26,530
Legal/Administrative Fees @ 5% of direct cost	LS			$13,265
	Total Indirect Costs Subtotal			$83,341
Total Capital Cost				$348,644
Operation & Maintenance Costs				
Groundwater (6) & Surface (4) Sampling (one round)				
Arsenic (6010), Level 3, 30 day TAT - filtered and unfiltered	EA	$12.26	20	$245
PCE (VOC-8260), Level 3, 30 day TAT	EA	$133.60	10	$1,336
Scientist	Hours	$75.00	30	$2,250
Technician	Hours	$55.00	24	$1,320
ODCs (low flow sampling equip, expendables, mileage)	LS			$800
Summary Data Report:				
Engineer	Hours	$75.00	16	$1,200
Senior Scientist	Hours	$90.00	8	$720
Data Manager	Hours	$75.00	4	$300
ODCs (copies, phone, etc.)	LS			$100
	Subtotal GW&SW Sampling			$8,271
Annual Groundwater & Surface Water Sampling - 2X/year				$16,542
Present Worth of 3-Year GW & SW Sampling Program 2X/year @7%, n=3 yrs				$43,412
Present Worth of 30-year GW&SW sampling - 1X/yr @7%, yr 4..yr30				$80,931
Total Present Worth of 30-year GW & SW sampling program for Area 2				$124,343
Wetlands Restoration Monitoring (2X/year - Wetland Scientist)	Hours	$75.00	20	$1,500
Present Worth of 5-year Wetland Restoration Monitoring (@7%, n=5 years)				$6,150
Institutional Control Inspections (1 event/year)	Hours	$90.00	12	$1,080
Present Worth of 30-year IC Inspections - 1X/yr @7%, n=30yrs				$13,402
Five-Year Site/Institutional Control Reviews (every 5 years for 30 years)				
Meetings:				
Senior Scientist	Hours	$90.00	8	$720
Engineer	Hours	$75.00	8	$600
Evaluate Data/Current Situation:				
Senior Scientist	Hours	$90.00	20	$1,800
Engineer	Hours	$75.00	40	$3,000
ODCs (includes photocopying, phone, etc.)	LS			$500
Five-year Report:				
Senior Scientist	Hours	$90.00	40	$3,600
Engineer	Hours	$75.00	60	$4,500
Associate Scientist/Data Management	Hours	$75.00	40	$3,000
Clerical (formatting, photocopying, production, distribution)	Hours	$45.00	8	$360
ODCs (includes photocopying, phone, etc.)	LS			$1,000
	Subtotal 5-year site review			$19,080
Present Worth 5-Year Review (@7%, n=5,10..30 years)				$41,169
Total O&M Costs Subtotal				$185,064

Total Capital and O&M Cost				$533,708
Contingency (@25 percent)				$133,427

TOTAL COST OF EXCAVATION FOR POSSIBLE FUTURE USE - AREA 2 **$667,135**

Cost Sensitivity Analysis - Minimum Estimate

Assume that the soil requiring excavation is reduced by 25% (160 CY, 288 tons, or 1 foot).
Assume groundwater will attain MCLs after one year. Add two extra years validation for a total of 3 years monitoring.
Assume wetlands monitoring will remain at 5 years and IC/site reviews will remain at 30 years.

Transport & Dispose RCRA Soil (assume 1/4 total soil)	Ton	$295.00	72	$21,240
Transport & Dispose MA99 Soil (assume 3/4 total soil)	Ton	$70.00	216	$15,120
Backfill/Restoration (clean fill- assume 80 CY X 1.25 bulk)	CY	$18.00	100	$1,800
Backfill/Restoration (wetland material - peat/compost-seed X 1.25)	CY	$30.00	100	$3,000
	Subtotal of decreased capital			$41,160

Total Capital Cost	$307,484
Present Worth of 3-Year GW & SW Sampling Program 2X/year @7%, n=3 yrs	$43,412
Total O&M Costs Subtotal	$104,133
Total Capital and O&M Cost	$411,617
Contingency (@25%)	$102,904

MINIMUM COST FOR POSSIBLE FUTURE USE ALTERNATIVE - AREA 2 $514,521

Cost Sensitivity Analysis - Maximum Estimate

Assume that the soil requiring excavation is increased by 25% (160 CY, 288 tons, or 1 foot).

Transport & Dispose RCRA Soil (assume 1/4 total soil)	Ton	$295.00	72	$21,240
Transport & Dispose MA99 Soil (assume 3/4 total soil)	Ton	$70.00	216	$15,120
Backfill/Restoration (clean fill- assume 80 CY X 1.25 bulk)	CY	$18.00	100	$1,800
Backfill/Restoration (wetland material - peat/compost-seed X 1.25)	CY	$30.00	100	$3,000
			Subtotal	$41,160

Total Capital and O&M Cost	$574,868
Contingency (@25 percent)	$143,717

MAXIMUM COST FOR POSSIBLE FUTURE USE ALTERNATIVE - AREA 2 $718,585

NON-DISCOUNTED COSTS FOR POSSIBILE FUTURE USE ALTERNATIVE - AREA 2
(assuming no inflation)

Total Capital Cost	$348,644
Total O&M Cost:	
- Annual Groundwater & Surface Water Sampling - 2X/year for years 1,2,&3	$49,627
- Annual Groundwater & Surface Water Sampling - 1X/year for years 4..30	$223,322
- Wetlands Restoration Monitoring (2X/year for 5 years)	$7,500
- Institutional Control Inspections (1 event/year for 30 years)	$32,400
- Five-Year Site/Institutional Control Reviews (every 5 years for 30 years)	$114,480
Total O&M Costs Subtotal	$427,330
Total Capitcal and O&M Cost	$775,974
Contingency (@25%)	$193,993
TOTAL NON-DISCOUNTED COST OF POSSIBLE FUTURE USE ALTERNATIVE - AREA 2	$969,967

AREA 2 - EXCAVATION FOR UNRESTRICTED USE (II-4)

Capital Costs

Direct Costs	Unit	Unit Cost	Quantity	Total Cost
Wetland Delineation/reporting	Day	$750.00	2	$1,500
Pre-Design Investigation (assume same COCs as confirmatory samples below:)				
- 2 days direct push drilling/soil sampling	Day	$1,200.00	2	$2,400
- Lead (6010), Level 3 (16 locations at 2 depths)	EA	$17.71	32	$567
- PCB (8082), Level 3 (16 locations at 2 depths)	EA	$84.47	32	$2,703
- Arsenic (6010), Level 3, 3 day TAT	EA	$14.73	32	$471
- EPH (MADEP), Level 3, 3 day TAT	EA	$172.23	32	$5,511
- Chromium (6010), Level 3, 3 day TAT	EA	$14.73	32	$471
	Pre-Design Investigation Subtotal:			$12,124
Soil excavation (1800 CY, 3240 tons)and offsite treatment/disposal:				
Mob/Demob (includes onsite storage)	LS			$8,500
Construct Decon Pad/Temporary Stockpile Areas/Erosion Control	LS			$6,000
Safety Barriers/Stockpile Maintenance	LS			$1,000
Clear trees from area to be excavated (medium trees); chip	Acre	$4,000.00	0.35	$1,400
Stump Removal (assume 20 medium size trees); remove soil	EA	$176.30	20	$3,526
Soil Excavation/Load Out Handling	Ton	$20.00	3240	$64,800
Dewatering	Gallon	$0.10	5000	$500
Transport & Dispose RCRA Soil (assume 1/4 total soil)	Ton	$295.00	810	$238,950
Transport & Dispose MA99 Soil (assume 3/4 total soil)	Ton	$70.00	2430	$170,100
Transport & Dispose Water	Gallon	$0.57	10000	$5,700
Backfill/Restoration (clean fill- assume 900 CY X 1.25 bulk)	CY	$18.00	1125	$20,250
Backfill/Restoration (wetland material - peat/compost-seed X 1.25)	CY	$30.00	1125	$33,750
Replant trees (estimate 1 per 15' offset)	EA	$80.00	65	$5,200
Re-install and develop 57M-95-04A and -04B	LS			$6,000
	Excavation Subtotal:			$565,676
Confirmatory Samples- 4,320 SF area(assume 1/900SF&every 30 feet along wall, plus 1/3 are resampled):				
Lead (6010), Level 3, 3 day TAT	EA	$17.71	50	$886
PCB (8082), Level 3, 3 day TAT	EA	$84.47	50	$4,224
Arsenic (6010), Level 3, 3 day TAT	EA	$14.73	50	$737
EPH (MADEP), Level 3, 3 day TAT	EA	$172.23	50	$8,612
Chromium (6010), Level 3, 3 day TAT	EA	$14.73	50	$737
Analytical screening - XRF for metals, immunoassay for PCB's,etc.	LS			$6,000
ODCs (sampling equip, H&S, expendables, mileage, courier)	LS			$2,500
Summary Data Report:				
Engineer	Hours	$75.00	40	$3,000
Senior Scientist	Hours	$90.00	20	$1,800
Drafting	Hours	$55.00	12	$660
Associate Scientist/Data Management	Hours	$75.00	8	$600
Clerical (formatting, photocopying, production, distribution)	Hours	$45.00	8	$360
ODCs (copies, phone, etc.)	LS			$500
	Subtotal Confirmatory Samples:			$30,614
Waste Characterization Samples of Soil:				
Full Characterization to determine if hazardous (1/200tons)	EA	$2,410.00	18	$43,380
Boundary Survey for Construction/Institutional Controls - Area 2	EA	$1,500.00	1	$1,500
Institutional Controls (land use restrictions)	LS			$13,000
	Direct Cost Subtotal			$667,793

Indirect Costs				
Design/Permitting @ 10% of direct costs	LS			$66,779
Wetland Restoration Plan	Day	$750.00	2	$1,500
Health and Safety @ 5% of direct cost	LS			$33,390
Pre-constr. mtg./stake locations/survey oversight	Day	$750.00	3	$2,250
Constructon Support Services @ 10% of direct cost	LS			$66,779
Legal/Administrative Fees @ 5% of direct cost	LS			$33,390
	Total Indirect Costs Subtotal			$204,088
Total Capital Cost Subtotal				$871,881

Operation & Maintenance Costs

Groundwater (6) & Surface (4) Sampling (one round)				
Arsenic (6010), Level 3, 30 day TAT - filtered and unfiltered	EA	$12.26	20	$245
PCE (VOC-8260), Level 3, 30 day TAT	EA	$133.60	10	$1,336
Scientist	Hours	$75.00	30	$2,250
Technician	Hours	$55.00	24	$1,320
ODCs (low flow sampling equip, expendables, mileage)	LS			$800
Summary Data Report:				
Engineer	Hours	$75.00	16	$1,200
Senior Scientist	Hours	$90.00	8	$720
Data Manager	Hours	$75.00	4	$300
ODCs (copies, phone, etc.)	LS			$100
	Subtotal GW&SW Sampling			$8,271
Annual Groundwater & Surface Water Sampling - 2X/year				$16,542
Present Worth of 3-Year GW & SW Sampling Program 2X's/yr @7%, n=3 yrs				$43,412
Present Worth of 30-year GW&SW sampling - 1X/yr @7%, yr 4..yr30				$80,931
Total Present Worth of 30-year GW & SW sampling program for Area 2				$124,343
Wetlands Restoration Monitoring (2X/year - Wetland Scientist)	Hours	$75.00	20	$1,500
Present Worth of 5-year Wetland Restoration Monitoring (@7%, n=5 years)				$6,150
Institutional Control Inspections (1 event/year)	Hours	$90.00	12	$1,080
Present Worth of 30-year IC Inspections - 1X/yr @7%, n=30yrs				$13,402
Five-Year Site/Institutional Control Reviews (every 5 years for 30 years)				
Meetings:				
Senior Scientist	Hours	$90.00	8	$720
Engineer	Hours	$75.00	8	$600
Evaluate Data/Current Situation:				
Senior Scientist	Hours	$90.00	20	$1,800
Engineer	Hours	$75.00	40	$3,000
ODCs (includes photocopying, phone, etc.)	LS			$500
Five-year Report:				
Senior Scientist	Hours	$90.00	40	$3,600
Engineer	Hours	$75.00	60	$4,500
Associate Scientist/Data Management	Hours	$75.00	40	$3,000
Clerical (formatting, photocopying, production, distribution)	Hours	$45.00	8	$360
ODCs (includes photocopying, phone, etc.)	LS			$1,000
	Subtotal 5-year site review			$19,080

Present Worth 5-Year Review (@7%, n=5,10..30 years)				$41,169
Total O&M Costs Subtotal				$185,064
Total Capital and O&M Cost				$1,056,945
Contingency (@25 percent)				$264,236
TOTAL COST OF EXCAVATION FOR UNRESTRICTED USE - AREA 2				**$1,321,182**

Cost Sensitivity Analysis - Minimum Estimate

Assume that the soil requiring excavation is reduced by 25% (450 CY, 810 tons, or 1 foot).
Assume groundwater will attain MCLs after one year. Add two extra years validation for a total of 3 years monitoring.
Assume wetands monitoring and site review will be 5 years and institutional controls will cease after 3 years.

Transport & Dispose RCRA Soil (assume 1/4 total soil)	Ton	$295.00	202.5	$59,738
Transport & Dispose MA99 Soil (assume 3/4 total soil)	Ton	$70.00	607.5	$42,525
Backfill/Restoration (clean fill- assume 225 CY X 1.25 bulk)	CY	$18.00	281	$5,058
Backfill/Restoration (wetland material - peat/compost-seed X 1.25)	CY	$30.00	281	$8,430
	Subtotal of reduced capital			$115,751
Total Capital Costs				$756,131
Present Worth of 3-Year GW & SW Sampling Program 2X/year @7%, n=3 yrs				$43,412
Institutional Control Inspections (1 event/year)	Hours	$90.00	12	$1,080
Present Worth of 3-year IC Inspections - 1X/yr @7%, n=3yrs				$2,834
From above: 5-Year Site Review	Subtotal 5-year site review			$19,080
Present Worth 5-Year Review (@7%, n=year 5)				$13,604
Total O&M Costs Subtotal				$66,001
Total Capital and O&M Cost				$822,131
Contingency (@25%)				$205,533
MINIMUM COST OF UNRESTRICTED USE ALTERNATIVE - AREA 2				$1,027,664

Cost Sensitivity Analysis - Maximum Estimate

Assume that the soil requiring excavation is increased by 25% (450 CY, 810 tons, or 1 foot).

Transport & Dispose RCRA Soil (assume 1/4 total soil)	Ton	$295.00	202.5	$59,738
Transport & Dispose MA99 Soil (assume 3/4 total soil)	Ton	$70.00	607.5	$42,525
Backfill/Restoration (clean fill- assume 225 CY X 1.25 bulk)	CY	$18.00	281	$5,058
Backfill/Restoration (wetland material - peat/compost-seed X 1.25)	CY	$30.00	281	$8,430
	Subtotal of increased capital			$115,751
Total Capital and O&M Cost				$1,172,696
Contingency (@25 percent)				$293,174
MAXIMUM COST OF UNRESTRICTED USE ALTERNATIVE - AREA 2				$1,465,870

NON-DISCOUNTED COSTS FOR UNRESTRICTED USE ALTERNATIVE - AREA 2
(assuming no inflation)

Total Capital Cost	$871,881
Total O&M Cost:	
- Annual Groundwater & Surface Water Sampling - 2X/year for years 1,2,&3	$49,627
- Annual Groundwater & Surface Water Sampling - 1X/year for years 4..30	$223,322
- Wetlands Restoration Monitoring (2X/year for 5 years)	$7,500
- Institutional Control Inspections (1 event/year for 30 years)	$32,400
- Five-Year Site/Institutional Control Reviews (every 5 years for 30 years)	$114,480
Total O&M Costs Subtotal	$427,330
Total Capitcal and O&M Cost	$1,299,211
Contingency (@25%)	$324,803
TOTAL NON-DISCOUNTED COST OF UNRESTRICTED USE ALTERNATIVE - AREA 2	$1,624,014

AREA 3 - LIMITED ACTION ALTERNATIVE (III-2)

Capital Costs

Direct Costs	Unit	Unit Cost	Quantity	Total Cost
Boundary Survey for Institutional Controls - Area 3	EA	$1,000.00	1	$1,000
Institutional Controls (land use restrictions)	LS			$13,000
	Direct Construction Cost Subtotal			$14,000
Indirect Costs				
Survey Oversight	Day	$750.00	1	$750
Administrative Fees	LS			$1,000
	Total Indirect Costs Subtotal			$1,750
Total Capital Cost Subtotal				$15,750

Operation & Maintenance Costs

Groundwater (5) & Surface (4) Sampling (one round)				
Arsenic (6010), Level 3, 30 day TAT - filtered and unfiltered	EA	$12.26	20	$245
Cadmium (6010), Level 3, 30 day TAT - filtered and unfiltered	EA	$12.12	20	$242
PCE (VOC-8260), Level 3, 30 day TAT	EA	$133.60	10	$1,336
1,4 - dichlorobenzene (PAHs, 8270), Level 3, 30 day TAT	EA	$296.83	10	$2,968
Scientist	Hours	$75.00	30	$2,250
Technician	Hours	$55.00	24	$1,320
ODCs (low flow sampling equip, expendables, mileage)	LS			$800
Summary Data Report:				
Engineer	Hours	$75.00	12	$900
Senior Scientist	Hours	$90.00	4	$360
Scientist/Data Management	Hours	$75.00	4	$300
Clerical (formatting, photocopying, production, distribution)	Hours	$45.00	4	$180
ODCs (copies, phone, etc.)	LS			$300
	Subtotal GW&SW Sampling			$11,202
Annual Groundwater & Surface Water Sampling - 2X/year				$22,404
Present Worth of 3-Year GW & SW Sampling Program 2X/year @7%, n=3 yrs				$58,794
Present Worth of 30-year GW&SW sampling - 1X/yr @7%, yr 4..yr30				$109,607
Total Present Worth of 30-year GW & SW sampling program for Area 2				$168,402
Institutional Control Inspections (1 event/year)	Hours	$90.00	12	$1,080
Present Worth of 30-year IC Inspections - 1X/yr @7%, n=30yrs				$13,402
Five-Year Site/Institutional Control Reviews (every 5 years for 30 years)				
Meetings:				
Senior Scientist	Hours	$90.00	8	$720
Engineer	Hours	$75.00	8	$600
Evaluate Data/Current Situation:				
Senior Scientist	Hours	$90.00	20	$1,800
Engineer	Hours	$75.00	40	$3,000
ODCs (includes photocopying, phone, etc.)	LS			$500

Five-year Report:				
Senior Scientist	Hours	$90.00	40	$3,600
Engineer	Hours	$75.00	60	$4,500
Associate Scientist/Data Management	Hours	$75.00	40	$3,000
Clerical (formatting, photocopying, production, distribution)	Hours	$45.00	8	$360
ODCs (includes photocopying, phone, etc.)	LS			$1,000
	Subtotal 5-year site review			$19,080

Present Worth 5-Year Review (@7%, n=5,10..30 years)	$41,169
Total O&M Costs Subtotal	$222,972
Total Capital and O&M Cost	$238,722
Contingency (@25%)	$59,681
TOTAL COST OF LIMITED ACTION ALTERNATIVE - AREA 3 (III-2)	**$298,403**

Cost Sensitivity Analysis - Minimum Estimate
Assume capital costs remain the same.
Assume groundwater will attain MCLs after 5 years. Add two extra years validation for a total of 7 years monitoring.
Assume IC/site reviews will remain at 30 years.

Present Worth of 3-Year GW & SW Sampling Program 2X/year @7%, n=3 yrs	$58,794
Present Worth of 4-year GW&SW sampling - 1X/yr @7%, yr 4..yr7	$30,973
Total O&M Costs Subtotal	$144,338
Total Capital and O&M Cost	$160,088
Contingency (@25%)	$40,022
MINIMUM COST OF LIMITED ACTION ALTERNATIVE - AREA 3	$200,110

NON-DISCOUNTED COSTS FOR LIMITED ACTON ALTERNATIVE - AREA 3
(assuming no inflation)

Total Capital Cost	$15,750
Total O&M Cost:	
- Annual Groundwater & Surface Water Sampling - 2X/year for years 1,2,&3	$67,211
- Annual Groundwater & Surface Water Sampling - 1X/year for years 4..30	$302,451
- Institutional Control Inspections (1 event/year for 30 years)	$32,400
- Five-Year Site/Institutional Control Reviews (every 5 years for 30 years)	$114,480
Total O&M Costs Subtotal	$516,543
Total Capitcal and O&M Cost	$532,293
Contingency (@25%)	$133,073
TOTAL NON-DISCOUNTED COST OF LIMITED ACTION ALTERNATIVE - AREA 3	$665,366

AREA 3 - EXCAVATION FOR UNRESTRICTED USE (III-3)

Capital Costs

Direct Costs	Unit	Unit Cost	Quantity	Total Cost
Wetland Delineation/reporting	Day	$750.00	1	$750
Soil excavation (120 CY, 216 tons)and offsite treatment/disposal:				
Mob/Demob (includes onsite storage)	LS			$5,000
Construct Decon Pad/Temporary Stockpile Areas/Erosion Control	LS			$3,000
Safety Barriers/Stockpile Maintenance	LS			$1,000
Soil Excavation/Load Out Handling	Ton	$20.00	216	$4,320
Dewatering	Gallon	$0.10	500	$50
Transport & Dispose Soil (assume MA99)	Ton	$70.00	216	$15,120
Transport & Dispose Water	Gallon	$0.57	500	$285
Backfill/Restoration (clean fill- assume 60 CY X 1.25 bulk)	CY	$18.00	75	$1,350
Backfill/Restoration (wetland material - peat/compost-seed X 1.25)	CY	$30.00	75	$2,250
Replant trees (estimate 1 per 15' offset)	EA	$80.00	8	$640
	Excavation Subtotal:			$33,015
Confirmatory Samples- 4,320 SF area(assume 1/900SF&every 30 feet along wall):				
EPH (MADEP), Level 3, 3 day TAT	EA	$172.23	10	$1,722
Analytical screening - test kit	LS			$2,000
ODCs (sampling equip, H&S, expendables, mileage, courier)	LS			$500
Summary Data Report:				
Engineer	Hours	$75.00	20	$1,500
Senior Scientist	Hours	$90.00	10	$900
Drafting	Hours	$55.00	4	$220
Associate Scientist/Data Management	Hours	$75.00	2	$150
Clerical (formatting, photocopying, production, distribution)	Hours	$45.00	4	$180
ODCs (copies, phone, etc.)	LS			$300
	Subtotal Confirmatory Samples:			$7,472
Waste Characterization Samples of Soil:				
Full Characterization to determine if hazardous (1/200tons)	EA	$2,410.00	2	$4,820
Boundary Survey for Construction/Institutional Controls - Area 2	EA	$1,000.00	1	$1,000
Institutional Controls (land use restrictions)	LS			$13,000
	Direct Cost Subtotal			$60,057
Indirect Costs				
Design/Permitting @ 10% of direct costs	LS			$6,006
Wetland Restoration Plan	Day	$750.00	1	$750
Health and Safety @ 5% of direct cost	LS			$3,003
Pre-constr. mtg./stake locations/survey oversight	Day	$750.00	2.5	$1,875
Constructon Support Services @ 10% of direct cost	LS			$6,006
Legal/Administrative Fees @ 5% of direct cost	LS			$3,003
	Total Indirect Costs Subtotal			$20,642
Total Capital Cost Subtotal				$80,699

Operation & Maintenance Costs

<u>Groundwater (5) & Surface (4) Sampling (one round)</u>				
Arsenic (6010), Level 3, 30 day TAT - filtered and unfiltered	EA	$12.26	20	$245
Cadmium (6010), Level 3, 30 day TAT - filtered and unfiltered	EA	$12.12	20	$242
PCE (VOC-8260), Level 3, 30 day TAT	EA	$133.60	10	$1,336
1,4 - dichlorobenzene (PAHs, 8270), Level 3, 30 day TAT	EA	$296.83	10	$2,968
Scientist	Hours	$75.00	30	$2,250
Technician	Hours	$55.00	24	$1,320
ODCs (low flow sampling equip, expendables, mileage)	LS			$800
Summary Data Report:				
Engineer	Hours	$75.00	12	$900
Senior Scientist	Hours	$90.00	4	$360
Data Manager	Hours	$75.00	4	$300
Clerical (formatting, photocopying, production, distribution)	Hours	$45.00	4	$180
ODCs (copies, phone, etc.)	LS			<u>$300</u>
	Subtotal GW&SW Sampling			$11,202
Annual Groundwater & Surface Water Sampling - 2X/year				$22,404
Present Worth of 3-Year GW & SW Sampling Program 2X/year @7%, n=3 yrs				$58,794
Present Worth of 30-year GW&SW sampling - 1X/yr @7%, yr 4..yr30				<u>$109,607</u>
Total Present Worth of 30-year GW & SW sampling program for Area 2				$168,402
<u>Wetlands Restoration Monitoring (2X/year - Wetland Scientist)</u>	Hours	$75.00	20	<u>$1,500</u>
Present Worth of 5-year Wetland Restoration Monitoring (@7%, n=5 years)				$6,150
<u>Institutional Control Inspections (1 event/year)</u>	Hours	$90.00	12	<u>$1,080</u>
Present Worth of 30-year IC Inspections - 1X/yr @7%, n=30yrs				$13,402
<u>Five-Year Site/Institutional Control Reviews (every 5 years for 30 years)</u>				
Meetings:				
Senior Scientist	Hours	$90.00	8	$720
Engineer	Hours	$75.00	8	$600
Evaluate Data/Current Situation:				
Senior Scientist	Hours	$90.00	20	$1,800
Engineer	Hours	$75.00	40	$3,000
ODCs (includes photocopying, phone, etc.)	LS			$500
Five-year Report:				
Senior Scientist	Hours	$90.00	40	$3,600
Engineer	Hours	$75.00	60	$4,500
Associate Scientist/Data Management	Hours	$75.00	40	$3,000
Clerical (formatting, photocopying, production, distribution)	Hours	$45.00	8	$360
ODCs (includes photocopying, phone, etc.)	LS			<u>$1,000</u>
	Subtotal 5-year site review			$19,080
Present Worth 5-Year Review (@7%, n=5,10..30 years)				$41,169
Total O&M Costs Subtotal				$229,122
Total Capital and O&M Cost				$309,822
Contingency (@25 percent)				$77,455
TOTAL COST OF EXCAVATION FOR UNRESTRICTED USE - AREA 3				$\boxed{\$387,277}$

Cost Sensitivity Analysis - Minimum Estimate

Assume that the soil requiring excavation is reduced by 33% (40 CY, 72 tons, or 1 foot).
Assume groundwater will attain MCLs after 5 years. Add two extra years validation for a total of 7 years monitoring.
Assume wetands monitoring will remain at 5 years and institutional controls will cease after 7 years.

Transport & Dispose Soil (assume MA99)	Ton	$70.00	72	$5,040
Backfill/Restoration (clean fill- assume 20 CY X 1.25 bulk)	CY	$18.00	25	$450
Backfill/Restoration (wetland material - peat/compost-seed X 1.25)	CY	$30.00	25	$750
	Subtotal of reduced capital			$6,240
Total Capital Cost				$74,459
Present Worth of 3-Year GW & SW Sampling Program 2X/year @7%, n=3 yrs				$58,794
Present Worth of 4-year GW&SW sampling - 1X/yr @7%, yr 4..yr7				$30,973
			Subtotal	$89,768
Institutional Control Inspections (1 event/year)	Hours	$90.00	12	$1,080
Present Worth of 7-year IC Inspections - 1X/yr @7%, n=7yrs				$5,820
From above: 5-Year Site/IC reviews	Subtotal 5-year site review			$19,080
Present Worth 5-Year Review (@7%, n=year 5 & 7)				$25,485
Total O&M Costs Subtotal				$127,223
Total Capital and O&M Cost				$201,683
Contingency (@25%)				$50,421
MINIMUM COST OF UNRESTRICTED USE ALTERNATIVE - AREA 3				$252,103

Cost Sensitivity Analysis - Maximum Estimate

Assume that the soil requiring excavation is increased by 33% (40 CY, 72 tons, or 1 foot).

Transport & Dispose Soil (assume MA99)	Ton	$70.00	72	$5,040
Backfill/Restoration (clean fill- assume 20 CY X 1.25 bulk)	CY	$18.00	25	$450
Backfill/Restoration (wetland material - peat/compost-seed X 1.25)	CY	$30.00	25	$750
	Subtotal of increased capital			$6,240
Total Capital Cost				$86,939
Total O&M Costs Subtotal (from previous)				$229,122
Total Capital and O&M Cost				$316,062
Contingency (@25%)				$79,015
MAXIMUM COST OF UNRESTRICTED USE ALTERNATIVE - AREA 3				$395,077

NON-DISCOUNTED COSTS FOR UNRESTRICTED USE ALTERNATIVE - AREA 3
(assuming no inflation)

Total Capital Cost	$80,699
Total O&M Cost:	
- Annual Groundwater & Surface Water Sampling - 2X/year for years 1,2,&3	$67,211
- Annual Groundwater & Surface Water Sampling - 1X/year for years 4..30	$302,451
- Wetlands Restoration Monitoring (2X/year for 5 years)	$7,500
- Institutional Control Inspections (1 event/year for 30 years)	$32,400
- Five-Year Site/Institutional Control Reviews (every 5 years for 30 years)	$114,480
Total O&M Costs Subtotal	$524,043
Total Capitcal and O&M Cost	$604,742
Contingency (@25%)	$151,186
TOTAL NON-DISCOUNTED COST OF UNRESTRICTED USE ALTERNATIVE - AREA 3	$755,928

Harding Lawson Associates
Engineering and Environmental Services

SHEET 1 OF 2
JOB NO. 45001 / 914404
DATE 4/4/2000
COMPUTED BY RDJ
CHECKED BY RTB

PROJECT AOC 57 FFS Report
SUBJECT Soil Volume Calculations

I. Compute the in-place soil volume for soils anticipated to exceed PRGs

A. Compute the areas for shaded areas depicted on

Figure 3-1, 3-3, & 3-5

Using Tamaya Digital Planimeter Planix 7 Serial No. 034900

1. Figure 3-1 Area 2 (Wetland Subsurface Soils - Possible Future Use)
Scale Set @ 1:720 (1" = 60')

4,352.41 ft^2
4,240.80
4,296.61
4,296.61
4,296.61

Avg = 4,296.61 ≈ 4,300 ft^2

2. Figure 3-3 Area 2 (Wetland Soils - Unrestricted Land Use)
Scale Set @ 1:720 (1" = 60')

11,829.62 ft^2
12,276.02
12,331.82
12,220.22
11,997.02

Avg = 12,130.94 ≈ 12,100 ft^2

3. Figure 3-5 Area 3 (Wetland Surface Soil - Unrestricted Land U
Scale Set @ 1:600 (1" = 50')

1,123.75
1,123.75
1,085.00
1,085.00
1,007.50

Avg = 1,085.00 ≈ 1,100 ft^2

PROJECT AOC 57 FFS Report
SUBJECT Soil Volume Calculations

B. Compute In-place Volumes

Area X Estimated Depth = Volume

Fig. 3-1 – Area 2 Possible Future Use – 4,297 ft^2 x 4 ft. = 17,188 cf
= 636 ≈ 640 cy

Fig. 3-3 – Area 2 Unrestricted Use – 12,131 ft^2 x 4 ft. = 48,524 cf
= 1,797 ≈ 1,800 cy

Fig 3-5 – Area 3 Unrestricted Use – 1,085 ft^2 x 3 ft = 3,255 cf
= 120.5 cy ≈ 120 cy

APPENDIX C

GROUNDWATER CLEANUP DURATION ASSUMPTIONS AND CALCULATIONS

Harding Lawson Associates
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SHEET 1 OF
JOB NO. 45001 9144-04
DATE 5/2/00
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PROJECT AOC 57
SUBJECT Groundwater quality recovery

Background / Objective

Releases of fuel hydrocarbons have resulted in the apparent mobilization of arsenic into groundwater caused by the onset of anaerobic conditions with the depletion of dissolved oxygen within the active zone of hydrocarbon degradation. With the removal (excavation) of residual hydrocarbons in soil, groundwater dissolved oxygen (DO) concentrations should recover, returning the aquifer to aerobic conditions. With this, the presently observed arsenic in groundwater should precipitate out to its more natural immobile state.

The following calculations estimate the potential return to aerobic conditions at Areas 2 and 3 at AOC 57. This is being estimated as the time to flush out the pore volume of groundwater associated with the identified areas contaminated by the fuel release. To be conservative, the calculation assumes two pore volumes of flushing will be required once the residual contaminants in soils are excavated.

Area 2

Length of contaminated area in the direction of groundwater flow ≐ 180 ft

Groundwater velocity estimate (App F of Draft Final RI)
= 0.04 to 14 ft/d, with mean = 1.56 ft/d

One pore volume estimated at:

$$\frac{180\,\text{ft}}{(1.56\,\text{ft/d})(365\,\frac{\text{d}}{\text{yr}})} = 0.32\ \text{yr.}$$

Two flushes would then take 0.6 years

A reasonable range would be 0.32 to 2 years

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SHEET 2 OF 2
JOB NO. 45001 9144-04
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PROJECT AOC 57
SUBJECT Groundwater quality recovery

based on the uncertainty in K and $\bar{V}$.

Area 3

Length of contaminated area in the direction of groundwater flow ≅ 190 ft.

Groundwater velocity estimate (App F of Draft Final RI)
= 0.14 to 1.76 ft/d, with mean = 0.37 ft/d

One pore volume estimated at:

$$\frac{190\ ft}{(0.37\frac{ft}{d})(365\frac{d}{yr})} = 1.4\ yr.$$

Two flushes would then take 2.8 yrs

A reasonable range would be 1 to 8 years based on the uncertainty in K and $\bar{V}$.

This analysis assumes the concern centers about the contaminated soil area. If concern extends to Cold Spring Brook, i.e. under worst case assumptions the depleted DO zone were to extend to the brook at Area 2, then the estimated time for flushing would be doubled. At Area 3, the stream is much further away about 500 feet, and any hydrocarbon plume is likely to be stabilized and the aquifer returned to aerobic conditions within that distance.

Further monitoring should be conducted following proposed further source area controls to observe dissolved oxygen and arsenic concentrations over time.